Science and Invention

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See Page 600

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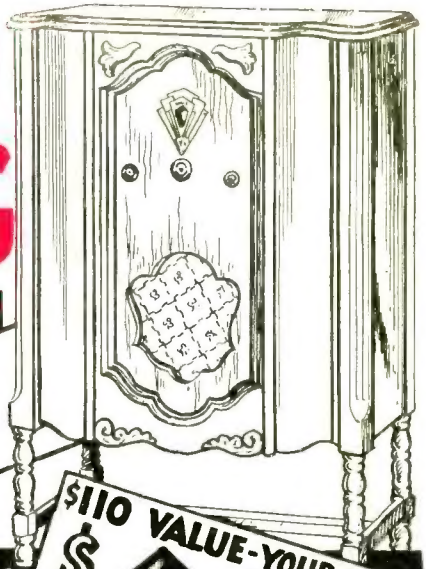

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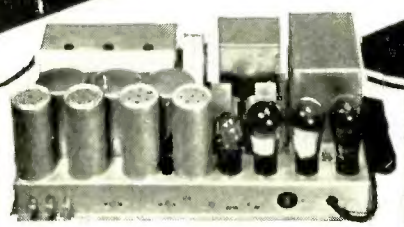

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National Radio Institute Dept., OMSSS
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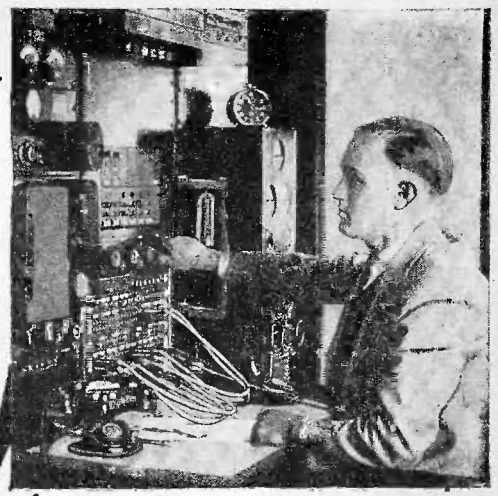

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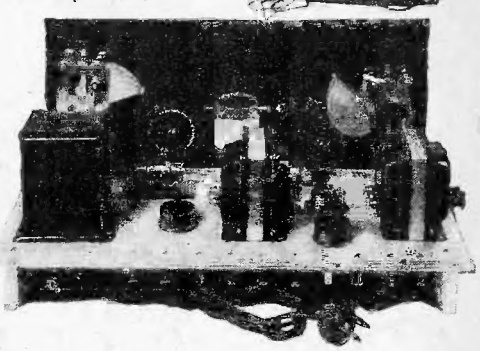

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NOVEMBER
1930

Science and Invention

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25c a copy
$3.00 a year

Published Monthly by
RADIO-SCIENCE PUBLICATIONS, Inc.
183-10 Jamaica Avenue, Jamaica, N. Y.
Publishers, B. A. MacKinnon and H. K. Fly; Editor, Joseph H. Kraus

$3.50 in Canada
$4.00 in Foreign

Entered as second class matter at the Post Office at Jamaica, N. Y., under the act of March 3, 1879.
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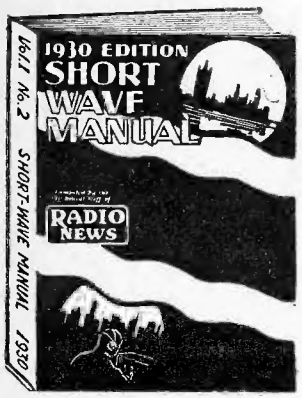

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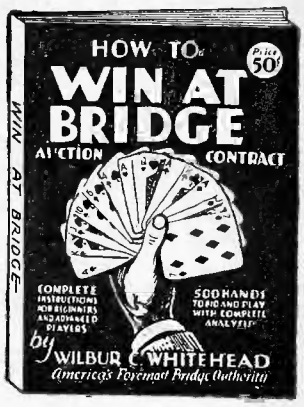

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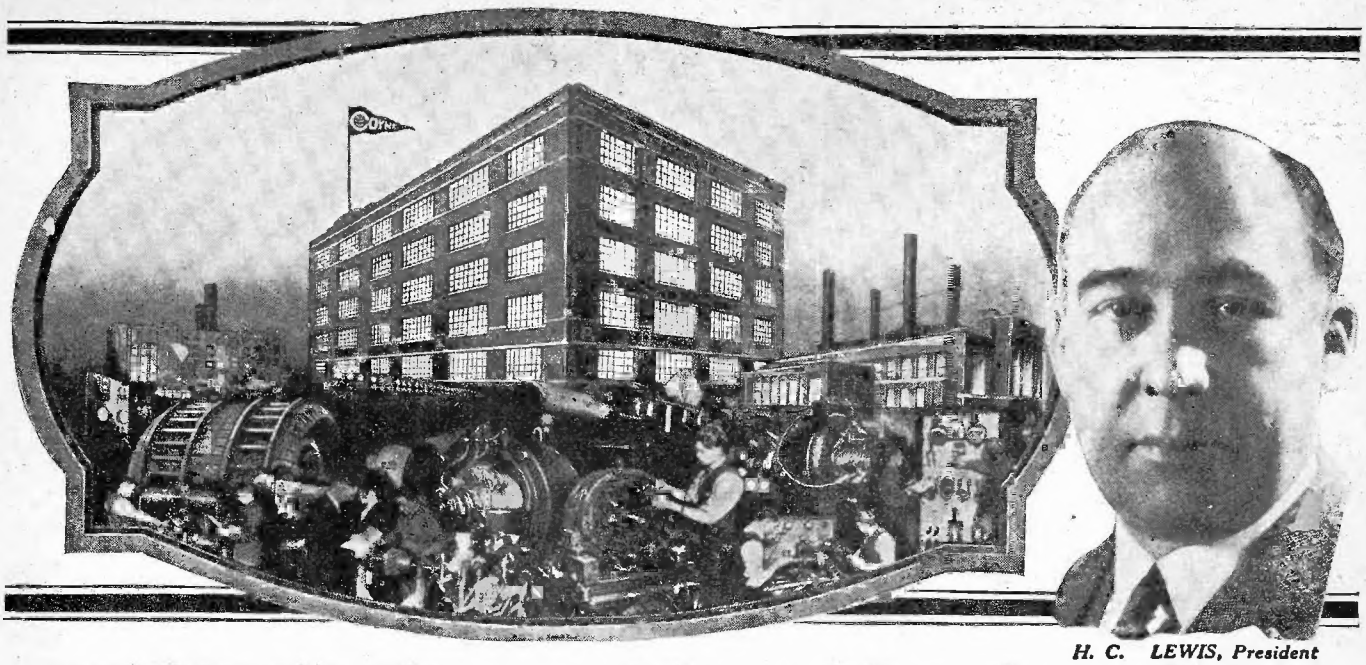

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We maintain a real employment service. If you should need part time work, I'll assist you in getting it, if you will just write and tell me your circumstances. In that way many earn while learning. Many of my students pay all their living expenses through part time jobs secured by Coyne.

Don't Worry About a Job

Coyne training settles the job question for life. Clyde F. Hart got a position as electrician with the Great Western Railroad at over $100.00 a week two weeks after graduation. That's not unusual. We can point to Coyne men making up to $600 a month. Coyne men get positions which lead to salaries of $50.00, $60.00 and up a week. You can go into radio, battery or automotive electrical business for yourself and make from $3000 a year up.

No Books—No Lessons

You work on real live electrical machinery, building real batteries, winding real armatures, operating real motors, dynamos and generators, wiring real houses, etc., etc.—here in this world famous parent school, with its hundreds of thousands of dollars worth of new up-to-date electrical equipment.

Prepare for Jobs Like These—

Coyne men have the advantages of getting positions which lead to those that are listed below. Our free employment bureau gives you lifetime employment service.

Armature Expert—$50 a Week and up.
Substation Operator—$65 a Week. Inventor—Unlimited.
Auto Electrician—$60 a Week and up.
Maintenance Engineer—$60 a Week and up.
Service Station Owner—$60 a Week and up.
Radio Expert—$60 a Week and up.

New $2,000,000 School

We are now in our new, fireproof, modern home wherein is installed thousands of dollars worth of the newest and most modern electrical equipment of all kinds. We now have a larger amount of floor space devoted to the exclusive teaching of practical electricity. Every comfort and convenience has been arranged to make you happy and contented during your training.

Electricity the Greatest of All Industries

Electricity is THE FIELD. It is one of the youngest. Every day sees an increase in its use. It holds the greatest future. The young man of today who gets into Electricity lays the cornerstone for lasting success—prosperity. Nearly every large building now needs trained Electrical men for maintenance. Every hotel, theatre, station—in fact Practical men are in demand everywhere—all the time.

Thorough Training that Results in Big Pay

My training is so thorough that you will be able to step out and get a job leading to big pay. Hundreds of Coyne graduates testify as to the thoroughness of my course and that if it hadn't been for this thoroughness, they never would have been able to have held their jobs. It's the wonderful, practical, learn-by-doing method which gives Coyne students such a thorough training.

Fascinating Method of Learning

Maybe you don't think this method of training isn't fascinating. The instructor shows you how to do job No. 1. Then you do it. Then he shows you how to do job No. 2. Then you do it. After while you're building real batteries that generate real juice; you wind real armatures that actually work and you do complete house wiring jobs. And all this time you'll find that it's so interesting you won't even realize that you are in school.

Lifetime Employment Service

My lifetime employment service not only helps you after you graduate, but from then on, throughout life, you are always welcome to call upon us for further employment service.

Every Possible Kind of Assistance

My organization is so thorough that you get every possible kind of assistance. We secure a clean room for you at the lowest rates. The welfare department looks after your comfort. We help you to get part time employment. We give entertainments for you. We help you to get a job when you graduate. We keep in touch with you, giving you the advantage of our entire staff should you run across knotty problems and need assistance.

My Big Book FREE!

Coyne is your one great chance to get into electricity. Every obstacle is removed. This school is 30 years old—Coyne training is tested—proven beyond all doubt—endorsed by many large electrical concerns. You can find out everything absolutely free. Simply mail the coupon and let me send you the big, free Coyne book of 150 photographs . . . facts . . . jobs . . . salaries . . . opportunities. Tells you how many earn expenses while training and how we assist our graduates in the field. This does not obligate you. So act at once. Just mail coupon.

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Safety Valve

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Building a Glider

ENCLOSED you will find a clipping about a glider being constructed by a friend and myself. The glider is being constructed

Local Youths Construct Home Made Glider

Motorless Ship Will Be Ready For Trials In August

A trim, graceful, motorless glider will be soaring over the housetops of St. Johnsbury in the near future if plans of two local airminded youths materialize.

After weeks of careful planning during which every specification on the famous Northrup glider was studied out, Russell Wheelock of Lafayette street and Harold Moore of St. Johns street under- construct a duplicate of

canvass and durability in all weather.

The glider is being constructed on specifications and plans published in Science & Invention. A few m made in the original plan famous N

following the directions given in SCIENCE AND INVENTION with the exception of a few minor details, namely:

We are using the Gottengen 441 airfoil section and the ½-in. spar instead of those given in the directions in your publication. Instead of wire in bracing the wings we are using diagonals of spruce.

We have a considerable amount of No. 16 piano wire. Is this suitable for use as flying or landing wires?

When the glider is given its trial spin, we will be glad to inform you as to the results.

RUSSELL A. WHEELOCK.
St. Johnsbury, Vt.

(No. 16 piano wire can be used in the building of a glider, but the wire is a little heavier than is actually required. We would appreciate hearing from the readers who are building gliders from these plans, with particular reference to the progress they are making.—EDITOR.)

Makes Furniture

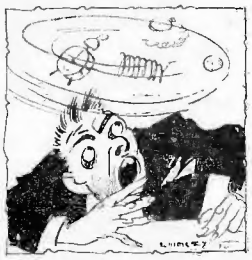
I HAVE been reading your magazine for many years and find it the most complete and up-to-date magazine of a scientific nature in the market.

I like H. L. Weatherby's construction articles in particular and have made many pieces of furniture from his instructions, which are now doing good service.

BURT KNUTSON,
Bismarck, N. D.

The Archimedes of Science and Invention

IN your solution of the Decimal-Clock Problem, your answer is different from mine, although both were worked in virtually the same method.



You say that 8:20 a. m. is 9/26 of a 24-hour day. But 8 × 60 + 20 = 500 minutes. The 24 hours are 1440 minutes. 500/1440 is 25/72 (not 9/26).

This correct (ed) fraction, applied to your operation, gives the answer: 22 2/9 seconds and 47 minutes past 3 o'clock, decimal time. And this is my answer.

I am enclosing the carbon copy of the solution I sent you, together with the solution of Problem No. 2 (which agrees with your answer: ⅝ lb.).

Poor old Homer used to get all the blame for nodding. Now it is the Archimedes of SCIENCE AND INVENTION. (By the way, that asbestos problem was first solved by Archimedes, was it not?)

May I not entertain the feeling that you will check my entries?

WILLIAM J. MARTIN,
Remillard Brick Co., San Francisco, Calif.

The solution given by Mr. Martin follows:

The regulation clock makes two revolutions of its hour-hand in twenty-four hours and the decimal clock but one. But (it is easy to conceive) the regulation clock can be slowed down one-half, the full day becoming one of twelve hours, and time being expressed by half of the customary divisions—thus: 8:20 is 4:10. The regulation and decimal clocks accordingly make one revolution and the hands move *pari passu*, oblivious of the different arbitrary divisions of "time."

In the *slowed-down* regulation clock there are 720 minutes (12 × 60) per full day and in the decimal clock 1000 minutes. The ratio is 1000:720, or 1:1.38 8/9. 4:10 (slowed-down time)—reduced to minutes (4 × 60 + 10) is 250 "regulation" minutes, which, multiplied by 1.38 8/9, is 347.22 2/9 decimal minutes, or 3.47.22 2/9 decimal hours, equal to

(Answer): 22 2/9 seconds, 47 minutes, past 3, decimal time.

(It is not the Puzzle Editor who nodded over the time problem.

You worked out your answer from a false start. The clock hands were not shown at 8:20, and it was told that the hands were at equal distance from 6. This made the time exactly 18 and 6/13 minutes past 8 o'clock a. m., which is 9/26 of the 24-hour day. The published solution is correct, as you will discover upon reviewing your work.—EDITOR.)

Reporter Cards

I AM one who praises and enjoys your magazine with its several interesting and wonderful introductions to science and invention.

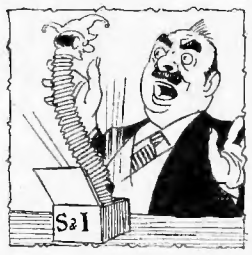
I am a junior at Boston University and would like very much to become an associate reporter for your magazine. I am sure that I may be able to contribute several interesting articles should they arise.

GEORGE J. GORNSTEM,
Roxbury, Mass.

(We have discontinued the practise of issuing reporter cards. We find that readers of SCIENCE AND INVENTION Magazine have a knack for obtaining news and do not require cards of any kind to properly present the subject matter which they desire to report upon. We are always open to suggestions and look over each and every article that is submitted.—EDITOR.)

Prize Winner Nearly Lost Out

THE September issue of SCIENCE AND INVENTION contained a big surprise for me. On page 410 I found my name among the prize winners. It may interest you to know that, after I had the plan drawn, I almost decided not to send it in, thinking I had no chance to win a prize. Finally, at almost the last minute, I decided to send it in anyway. Needless to say, the results greatly exceeded my expectations.



ALLEN CUNNINGHAM,
Coatsburg, Ill.

(We congratulate you in winning one of the five fourth prizes of $20.00 *in the "Basement Plan" contest that was conducted by this magazine.*—EDITOR.)

An Outboard Motorboatist

I LIKED your article in August SCIENCE AND INVENTION on outboard motors and think you have discussed the subject admirably. It is one of the best of its kind I have read and well worth the price of subscription.

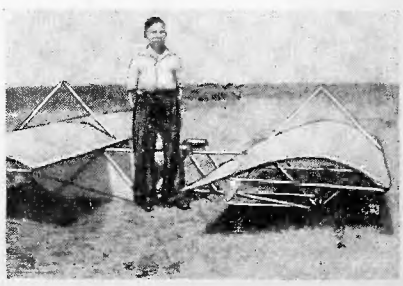
N. T. LERSCH,
New York City.

Another Glider Bug

AM sending you a picture of myself and glider built from plan in the August, 1929, issue.

JACK QUEEN,
Perry, Okla.

(Good. And how do you like sailing ships of the air?—EDITOR.)



(Continued on page 667)

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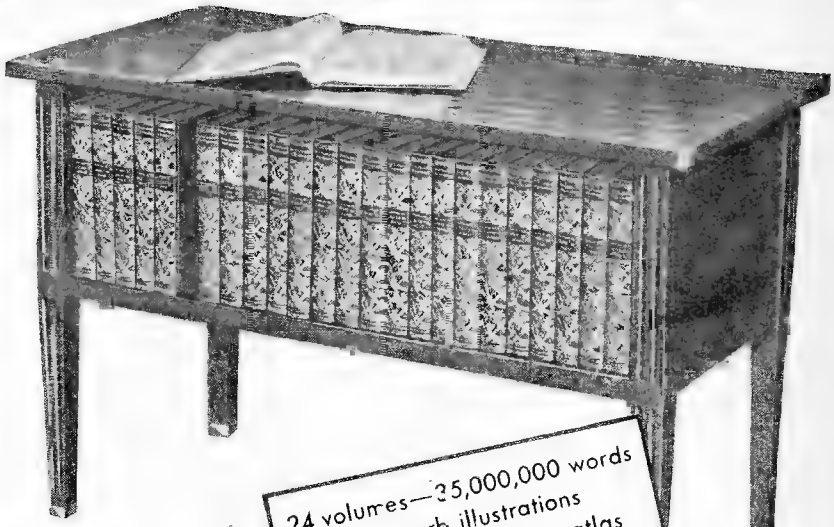

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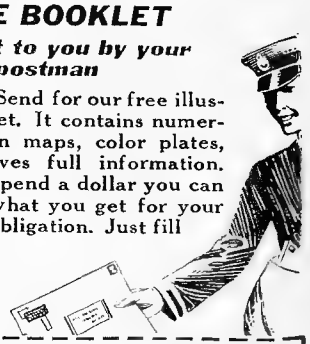

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NOVEMBER, 1930
NUMBER 7

Science and Invention

VOLUME XVIII
WHOLE NO 211

Published by Radio-Science Publications, Inc. 381 Fourth Ave. New York City, N. Y.
B. A. MACKINNON and H. K. FLY, Publishers
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Editorial

Transatlantic Air Travel

THE Atlantic has been flown again, once each way by the British dirigible R-100, and twice from east to west by the German flier Capt. Wolfgang von Gronau and his companions, and by the French ace Capt. Dieudonné Coste and his companion Maurice Bellonte, the German in a flying boat and the Frenchman in a land plane.

In these accomplishments we have examples of long-distance flights by the only three forms of aircraft which have emerged from the experimental stage and proved their ability to cover relatively short distances with a pay load. Whilst we naturally regard these flights as being of considerable importance, and extend our heartiest congratulations to those responsible for them, it is not with the spectacular nature of these feats that we wish to deal here; we want to discuss the higher aim behind them, which is to establish a regular transatlantic air travel service.

Capt. Coste's plane is the fourteenth to cross the North Atlantic, and the fifth to make the highly dangerous east to west flight. The first heavier-than-air machine to cross the Atlantic was the United States Navy flying boat, NC4, which flew across in stages in May 1919. The following month Messrs. Alcock and Brown, British fliers, made a single hop from Newfoundland to Ireland, and the first dirigible flight was made in the same year by the British airship R-34.

To the casual observer, but little progress would appear to have been made in the eleven years which have elapsed since these historic flights. Flying across the Atlantic is still in the nature of a spectacular stunt, especially in a heavier-than-air machine. A regular paying service is still far off in the future. The difficulties which lie in the way may be classified under two heads, not unrelated, (1) meteorological conditions and (2) the provision of sufficient power without undue increase in weight.

We have always been of the opinion that aviators did not have the slightest idea of meteorological conditions over the Atlantic; if they had, some of the attempts would never have been made, and the science of aviation would have been the poorer. At any given time meteorologists on land cannot be certain of conditions over the whole route; the record of Capt. Coste's flight proves that. Only sailors know intimately what conditions to expect. They know that, despite forecasts to the contrary, storms of terrific intensity can on occasion arise suddenly without the slightest warning, barometric or otherwise. Under these circumstances it is folly to attempt a flight without the provision of two-way radio communication so that information can be collected from ships en route.

Before a commercial transatlantic air service can be established on a regular schedule, therefore, it would appear to be essential in the first place to tighten up the organization of meteorological services; cross-country flying has already proved that necessity. In the second place, heavier-than-air machines, to be safe from engine failure, should have at least three motors, and to be safe against being taken by surprise by storms they should be capable of a maximum speed of not less than 150 M. P. H.—preferably 200 M. P. H.—so that they can successfully contend with the not infrequent 100 M. P. H. hurricanes. This involves the development of increased power. Flying boats are much more logical machines to employ than land planes, coupled with the development of floating refuelling stations so that the pay load may be increased.

The recent experiences of both the Graf Zeppelin and the R-100 indicate that fabric envelopes should be replaced by metal coverings in order to make airships safe.

But the most important mechanical requirement is the provision of a considerably increased power-weight factor.

A. Dinsdale

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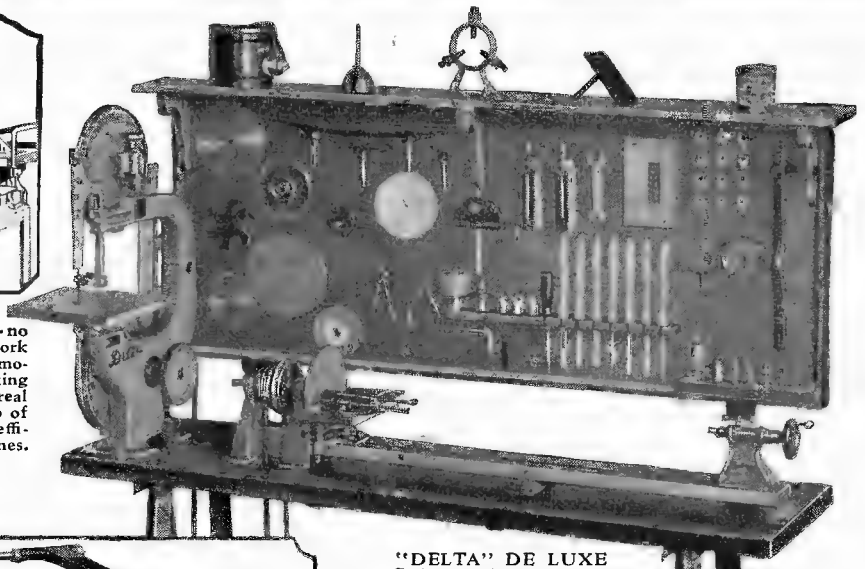

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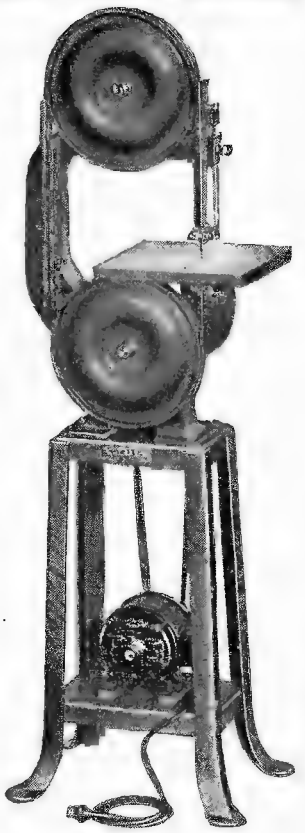

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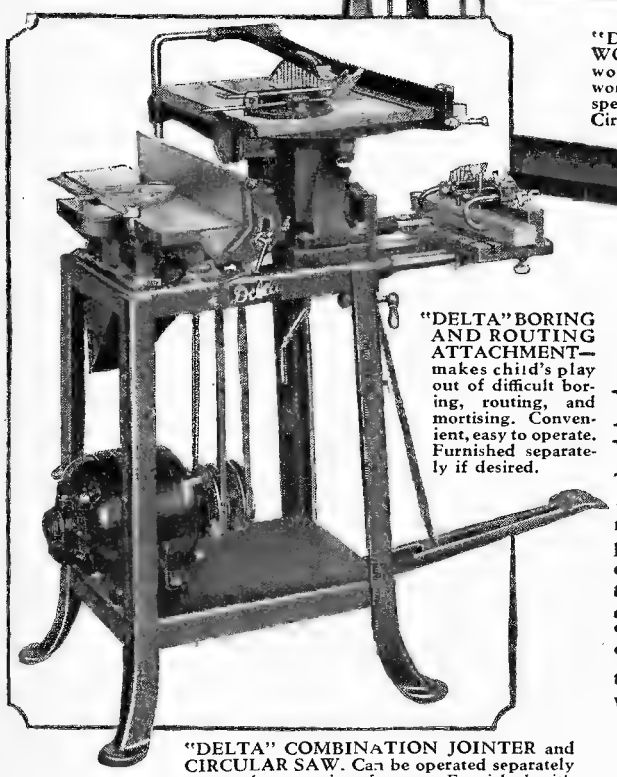

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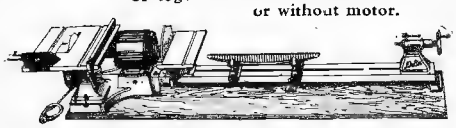

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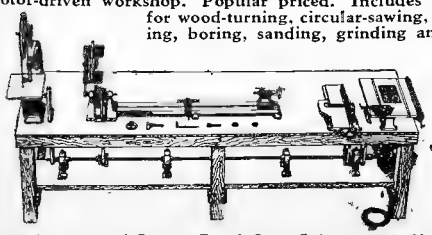

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SCIENCE AND INVENTION

VOLUME XVIII, NUMBER 7

NOVEMBER, 1930

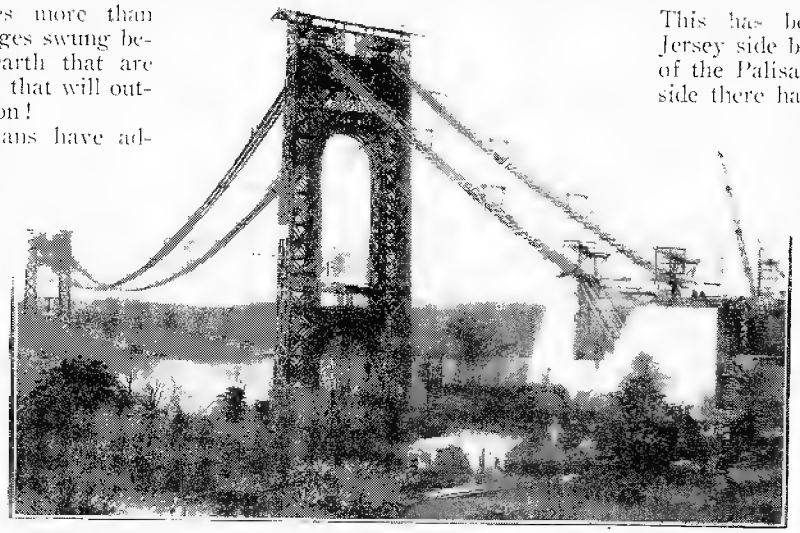
Making Modern Suspension Bridges Safe

By Don Charles
Correspondent and Special Writer

New Methods Make It Possible to Build Suspension Bridges Twice as Long as the New One Being Built Across the Hudson Between New York and New Jersey

SUSPENSION bridges more than two miles long! Bridges swung between heaven and earth that are hurricane proof! Bridges that will outlast our present civilization!

Modern engineering plans have advanced so rapidly as a result of the planning and construction methods used in the new suspension bridge now being constructed across the Hudson between New York and New Jersey that it is possible that the future will see suspension bridges more than two miles in length, and hurricane proof. Not even a tornado will cause them to swing, nor could a cyclone make them tremble.



View of the new Hudson River Bridge, taken from Riverside Drive.

Since the first suspension bridge was placed over Niagara the method of construction has undergone many changes and has been modernized by the use of electric compressing machinery for cables, giant weavers that travel back and forth spinning a bridge through the air, and scientifically-designed anchorages that the most terrible earthquake could not destroy.

The new Hudson River bridge is a marvel of engineering. It is suspended on four cables, each made up of 26,474 steel wires .196 of an inch in diameter. Each wire has a strength, accurately tested by new electrically-driven machines, of at least 220,000 pounds to the square inch.

The four main cables are 36 inches in diameter and will weigh 28,450 tons. They will support a weight of 350,000 tons, although they will never be called upon to carry more than approximately one-quarter of this weight.

Travelers across this structure may feel absolutely safe when they know that these great cables, made up of more than 100,000 steel wires, would support four similar structures at the same time. This is the "factor of safety" by which bridge engineers eliminate any chance of collapse. Engineers say that even hurricanes would not make the bridge swing; that a storm would beat against the bridge with about as much effect as a child leaning against the great pyramid!

The cables of the new bridge are anchored at each end in solid rock. This has been accomplished on the Jersey side by digging into the bedrock of the Palisades, and on the New York side there has been built a great block of reinforced concrete, now a landmark for tourists coming into New York by way of the Riverside Drive extension. This great "anchor" is 290 feet long, 200 feet broad and roughly 130 feet high.

Imbedded in the rock and cement are numbers of steel beams connected to massive eyebars, which act as the cable terminals.

By such simple basic methods, with exacting tests, the longest bridge in the world is being put in place. It is twice as long as the second largest, the Delaware River Bridge at Philadelphia, and has a main span length of 3,500 feet as against a span of 1,750 feet for the Delaware bridge, and of only 1,590 feet for the Brooklyn Bridge.

How do engineers know that such a huge structure is safe? How can they tell, when they have never built a bridge more than half the size of the new one? How can they do more than guess? But the engineers who have given years to planning and testing, before actually starting work on the bridge, have considered nothing but cold fact and known conditions. They know exactly what they are doing.

Before the design was decided upon, two methods of suspension were con-

Showing the spinning machinery at the New York anchorage side. These gigantic spinners travel back and forth, putting the cables in shape and actually making them.

sidered—the parallel wire method and the eyebar cable method. The former was chosen, one of the deciding factors being the cost. The parallel wire cable work and some of the steel work for joining the cables to the anchorages, as well as the actual construction work, were done by John A. Roebling Sons Company, who built the famous Niagara and Brooklyn bridges. For more than a year they carried an analysis, experiments with full size and model tests, and other work.

Because of the impossibility of transporting and raising these great cables in one piece from the factory to the bridge, the cables are being built in their final place and position on the bridge itself. The wires are manufactured at the factory and shipped in reels to the bridge site, where they are spun across the river with cable-spinning apparatus which travels back and forth on an aerial tramway.

Before any of the cable-spinning work could be done an initial cable had to be drawn across by a tug-boat and barge and the two ends lifted to the towers and finally stretched in the air. After this other cables were drawn across, and two sets of cables were adjusted for supporting the catwalks which had been built, in order that the cables could be "formed" from the spun wires.

For suspending the catwalks one on each side of the towers, 36 powerful cable ropes nearly three inches in diameter were made and hoisted into position from cable anchorage to cable anchorage over the tower tops. These cable ropes are a mile long. The steel framework sections of the catwalks were fastened to them, starting from the center of the span, by means of a traveling cage.

On the catwalks the actual compacting of the smaller sets of cables that go to make up the four 36-inch cables has been going on. The wires are being strung and compacted at the rate of about 200 tons of single wire a day. For the final compacting a circular multiple hydraulic jack was developed. Its job is to squeeze the smaller cables into a large circular area, so that they can be bound with steel wire into permanent shape.

The operation of this newly developed device was tested out on a full-size section of cable at the factory. The circular jack is placed around the cable and the twelve hydraulic jacks of which it is composed squeeze the cable into tube shape with a pressure of 720 tons. Steel bands are applied to hold it in form until a spiral lapping of steel wire covering is applied, as well as a final covering of waterproof material.

Such methods make it unnecessary to replace cables as has been necessary at times in the Brooklyn Bridge. The cables will last many times the life of the bridge and cannot be weakened. The wire used in the cables is of a material that will safely carry year in and year out, a greater load per unit area than any other structural material. It is made by the "cold-drawn" process. The steel is made by the open hearth method and cast into ingots about five feet in length and five inches square. After it has been chemically treated and analyzed the ingots are reheated and passed through rollers to reduce them to a square of about two inches. These are cut into billets about thirty feet in length and then rerolled to a diameter of approximately 3/8 of an inch, and are coiled and tempered before being cold-drawn into wire.

This drawing process is done in four operations, by pulling the wire through dies with holes of progressively smaller diameter. By this method there is produced 4,000 linear feet of wire for each thirty-foot billet.

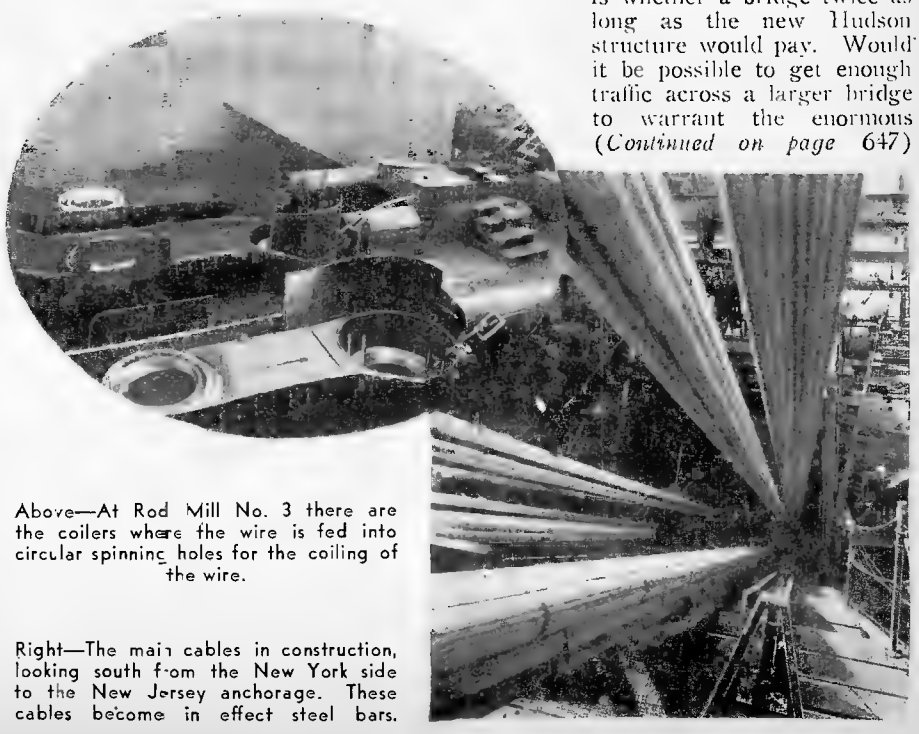
The wire is then galvanized—covered with a coating of almost pure zinc to protect it against corrosion. Then it is spliced and wound on six-foot reels, each reel holding about thirty miles of wire and weighing about eight tons. Finally it is shipped on special freight cars to the bridge, where it is spun in position for building the subcables of which the four great cables are to be formed.

There are many kinds of special steels used in modern cables which were unknown in other days—in the great girders of the towers, in the sleepers of the anchorages, in the connecting eyebars, in the beams for the roadways, and in other points of the structure where stresses must be supported with security.

Metallurgists have been able to increase the strength of iron by numerous processes of heat treatment and drawing, as well as adding alloys, so that in reality the cables will support much greater stresses than at one time was thought possible, and do this almost indefinitely.

The limiting factor in bridge length is no longer that of material or design, but rather that of profit. The question is whether a bridge twice as long as the new Hudson structure would pay. Would it be possible to get enough traffic across a larger bridge to warrant the enormous

(*Continued on page* 647)

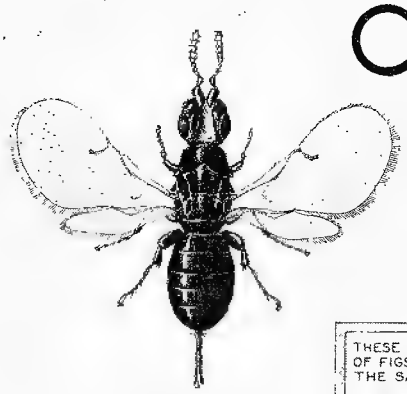


Above—At Rod Mill No. 3 there are the coilers where the wire is fed into circular spinning holes for the coiling of the wire.

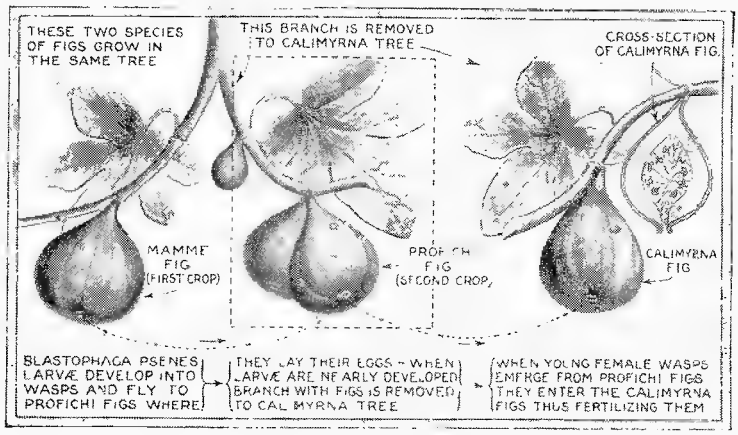
Right—The main cables in construction, looking south from the New York side to the New Jersey anchorage. These cables become in effect steel bars.

On the Shoulders of a Wasp Rests an Entire Industry

By George A. Pettitt
Associate Editor, *California Monthly*



The wasp which fertilizes the Calimyrna Fig, 27 times natural size. Actually the insect is less than 3/16 inches in wing span.


THESE TWO SPECIES OF FIGS GROW IN THE SAME TREE
THIS BRANCH IS REMOVED TO CALIMYRNA TREE
CROSS-SECTION OF CALIMYRNA FIG
MAMME FIG (FIRST CROP)
PROFICHI FIG (SECOND CROP)
CALIMYRNA FIG
BLASTOPHAGA PSENES LARVÆ DEVELOP INTO WASPS AND FLY TO PROFICHI FIGS WHERE
THEY LAY THEIR EGGS - WHEN LARVÆ ARE NEARLY DEVELOPED BRANCH WITH FIGS IS REMOVED TO CALIMYRNA TREE
WHEN YOUNG FEMALE WASPS EMERGE FROM PROFICHI FIGS THEY ENTER THE CALIMYRNA FIGS THUS FERTILIZING THEM

The complicated process by which the Calimyrna fig is fertilized is graphically represented in this drawing.

In this cluster of Caprifigs, the mature mamme figs are below, the immature profichi figs at the top. Migration of wasps is beginning.

For a Thousand Years the Smyrna Fig Has Been Matured by Pollen Carried Into It by a Wasp . . . But the Calimyrna Fig (American Smyrna Fig) Within the Past Few Years Has Been Blighted by a Fungus which the Fertilizing Insect Picks Up with the Pollen. . . . The Battle of Scientists to Save the Wasp and Destroy the Fungus Is the Theme of This Absorbing Article.

EXTERMINATION campaigns *against* insects, even those which require the importation of mercenary armies of insects to do the fighting, are an old story in this scientific age; but to support science's reputation for having something new every minute, a determined group of scientists and farmers in California is now waging a campaign to *bring a few billion billion baby insects into the world* as hygienically as human babies in a hospital.

The insect concerned is a tiny wasp known as the *Blastophaga psenes*, whose wing spread is less than three-sixteenths of an inch, but upon whose fragile shoulders rests the future of America's Calimyrna fig industry.

The Calimyrna fig is the American cousin of the famous Smyrna fig, which for thousands of years has been known wherever ships and trade could reach. It is accepted as one of the best possible varieties for drying because of its rich, golden color, tender skin and good flavor. But it is also a very primitive variety of the species *Ficus carica*, or edible fig, and unlike any other variety, it requires fertilization, or caprification as it is called, by pollen from an entirely different tree, the Caprifig. Without this pollen, while other figs are maturing to a luscious sweetness, the Smyrna figs sulk, shrivel up and drop from the trees. That is where the tiny *Blastophaga psenes* plays its part. The fig wasp is the only insect known that will cooperate with man by carrying this pollen to the thousands of waiting figs in the Smyrna orchards.

To prevent infection of the Calimyrna, the scientists treat the mamme crop with fungicide just before the wasps migrate to the profichi crop of the Caprifig tree.

Circle — A fungus growth (center) around a wasp from an untreated fig, contrasted with the lessened fungus growth on seven treated figs. Left— Edith Phillips, scientist sent by the University of California, studying the figs.

Within the last few years a strange blight has struck the Calimyrna figs. Approximately half of California's 58,000 acres of figs are Calimyrnas according to the best estimates obtainable; yet from 1923 to 1927 only 16 per cent. of the marketable figs were Calimyrnas. Figs of all varieties suffered, but the Calimyrna, living up to its reputation as the pampered darling of the fig industry, suffered worst of all. A large percentage of the crop rotted on the trees, an additional percentage could not be marketed, and more was fit only for jams, bakery filling, or stock feed. The loss was estimated to be in excess of a million dollars annually. Worst of all, when scientists were called in to study the trouble, they found that the Calimyrna figs had a strange disease of their own, and that that disease was carried by the fig wasp, without which there would be no Calimyrna figs. That is why science is trying to raise hygienic wasps.

Ever since its first importation to California, fifty years ago, the Calimyrna fig has been a puzzle to orchardists. Several years passed before Californians discovered that the fig wasp was a necessary part of the Calimyrna industry, and ten more years passed before the wasps could be persuaded to adapt themselves to their new home. It was even longer (*Continued on page* 660)

Landlords—Ha-Ha!

Just Pick Carefully When You Settle Down and No One Will Bother You with a Monthly Bill for Rent

They call the smiling fellow on the left a "Troglodyte," but you'd have to think up a worse name than that to fineigle him into moving to a place where he'd find a monthly rent bill in the mailbox. Right—Houses built into cliffs by French peasants (Department of Seine) require few windows or doors and are warm in winter, cool in summer.

Above—These heavy-browed dwellings are built into the faces of rocks 500 feet high, about 100 feet from the summit, and are located in Ceylon. . . . On the right observe an ancient apartment house built in a cliff in a 1,000-foot canyon wall in Arizona—a trifle higher than any apartment rent could reach at that time.

Above—Peasant Indians long ago built this apartment house in the land of the sky, overlooking a somewhat hostile part of New Mexico. Modern Manhattanese say they showed rare judgment.

Left—Like wasps' nests are the mud humps built by the Troglodyte Tunisians in the Sahara—one door, outside steps, no windows. And their inhabitants are like wasps, too. From such huts as these they have gone forth to sting many a desert-crossing caravan for its roll. . . . On the right appears an apartment group in Germany, at Neberlingen on the Bodensee, right under the wing of Mother Earth.

All photos by Ewing Galloway

Boeing Airplane Co.
Mounting the wings on a Boeing biplane.

Sky Jobs and Ground Jobs

By Orville H. Kneen

Author of Everyman's Book of Flying

A Large Proportion of the Younger Generation Today Is Turning to Aviation in Its Search for a Career. . . . To These, the Following Survey of the Occupational Possibilities of the Aviation Industry, by a Man Who Has Made It a Special Study, Will Be Welcome and Useful Reading

NINE out of ten young men today, it is estimated, are looking for an aviation job. Their first aim is always the pilot's berth—hard work sometimes, but short hours—and pay that, for those at the top, ranges up to $8,000 or more a year. The pilot of a transport ranks higher than a locomotive engineer. One of the largest of employers told me:

"Our conception of the transport pilot of the future is an individual similar to the captain of an ocean liner." Several thousand hours in the air, and nearly as many dollars, must be invested before one can command a big airliner and a big salary.

But there are scores of other jobs in aviation, aloft and aground, for those who train themselves. The flying mechanic will soon be common. Thus the 112-passenger DO-X, when it flies the Atlantic to this country, will carry several mechanics equipped to make flying repairs.

Then there are the couriers or stewards, who look after the welfare of passengers; navigators; radio operators; flying mail clerks; aerial chefs, and so on. There are even flying stenographers and secretaries, for big business men with flying offices for rapid trips.

Nine-Tenths Are on the Ground

Young as the aviation industry is, it employs directly and indirectly about 100,000 persons. One-tenth are pilots. So for every aerial job there are nearly nine on the ground. In a large aircraft plant near New York City I recently saw former cabinetmakers carefully erecting the cabin of an airliner.

A few weeks of skillful work by machinists, metal workers, fuselage and landing gear experts, welders, fabric coverers, painters, dopers, electricians, motor installers, riggers and assemblers, not to mention engineers, checkers and inspectors, and this great plane will take to the airways, taking 21 persons at 116-miles-an hour cruising speed.

The employment manager tells me that almost all his men are skilled, with three years or more of experience. Machinists usually get their training in other metalworking plants. Carefulness is essential, for mistakes are costly. Quantity production and low-unit costs are not yet possible in aircraft plants.

Welders are usually specially trained for aircraft work, for the complicated joints in fuselage tubing require great skill, and lives and money depend upon good work. Only one plant has as yet adapted electric arc welding to aircraft—the Boeing Airplane Company of Seattle.

In the wood mill and dry kiln are prepared the spruce and other light, strong wood stock. In the wing panel shop, pattern and model shop, veneer wing-covering department, etc., woodworkers are numerous. Women may be seen cutting and sewing cotton fabric for wing covering; others nail wood ribs together in a jig, and do other odd jobs.

The mechanically-inclined today are eagerly seeking openings as helpers or apprentices, leading to such well-paid jobs as sheet metal or cowling expert, coppersmith, tinner, etc. The best cowling men get up to $1.25 an hour and are scarce. Dural sheet, beginning to be used for wing and fuselage covering, requires expert workmen. Steel workers fabricate, rivet and assemble angle iron shapes, channels, round, flat and square dural tubing, etc.

Ryan Aircraft Corp.
Welding a fuselage at the Ryan plant.

Fokker trimotor plane flying for the Western Air Express.

Then there are special lines such as upholstering; plumbing; electrical and radio installation; tank fabrication and installation; heat treating of metal parts; chromium and nickel plating; cable work; hull work on flying boats; radiator fabrication and installation; soundproofing and insulating, etc.

In allied lines are large plants producing carburetors, magnetos and ignition systems, starters, propellers, floats, brakes, wheels and tires, instruments, radio equipment, airport lights and beacons, parachutes, etc.

Such jobs lead to higher positions such as licensed mechanic on airplanes and engines; group foreman; inspector; shop manager, etc. Shop work is the best of training for the engineer, who may take home-study work when he cannot afford a four-year aeronautics course in college.

In one plant I recently met the foreman of the aileron and tail department. He told me he began his aircraft work some six years ago by making models. He sent one to the plant manager, and a job resulted. This method would hardly get a job today. Nevertheless, it is a good indication of the value of building models and studying aircraft design.

There are many who study aeronautics while they work at the detail jobs, such as designing fittings, landing gear, engine parts, wiring layouts, tools and jigs, etc. In a typical plant in New Jersey the Engineering Department has the following:

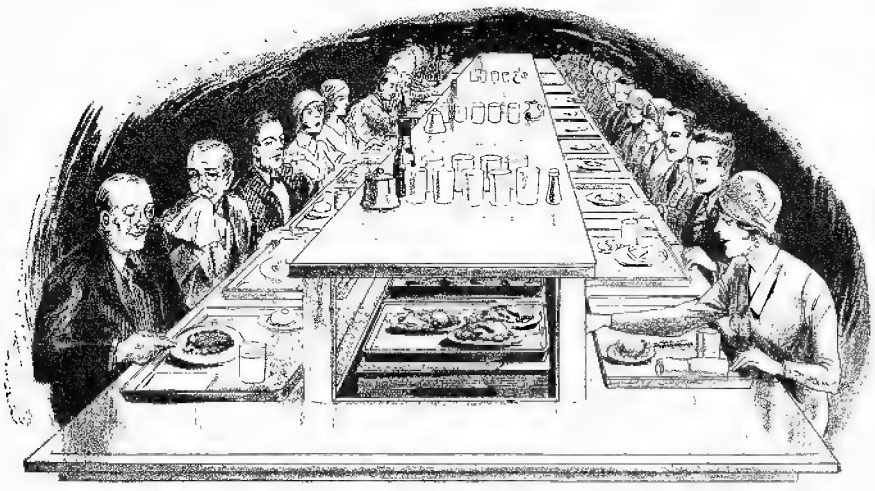
4 project engineers
29 draftsmen, one chief and 3 juniors
5 bill of material clerks, who check items, compute weights, etc.
4 stress analysis clerks, who compute strength of each part
4 blueprint operators, who make prints from tracings
5 tool and jig designers
3 file clerks
3 stenographers

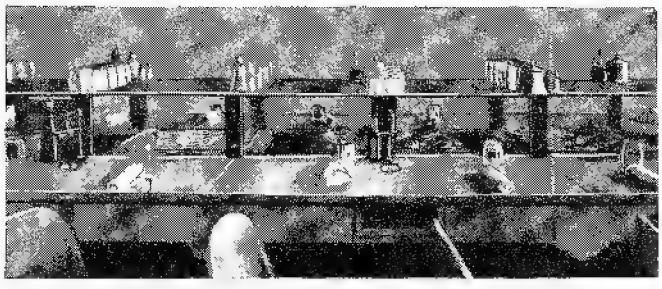
Apprentices Get a Chance

Some plants have a complete experimental department, with mechanics, draftsmen and helpers. Mechanics and engineers get the best of training in shops where airplanes are inspected, overhauled and maintained. Apprentices are employed in some plants, at around 45 cents an hour. It is reported that boys (*Continued on page* 649)

Bringing the Food to the Man

By Richard Graves





All food passes in front of each patron on an endless conveyor at a speed allowing him ample time to select the quantity he desires. When he is through eating, he slips his dishes through the trap door under the counter (left); a rubber belt takes them to the kitchen.

PAY fifty cents as you enter, and you can eat as much as you want of everything in a new type of restaurant which has recently been opened in an Idaho city.

The food passes the counter, as may be seen in the photograph, on an endless conveyor. The conveyors, extending from the kitchen to the dining room, carry trays of food past the patron, who chooses any dish that may take his fancy. The conveyor carrying the trays is enclosed in glass and a glass door directly before each seat may be lowered and any article removed to the counter.

When the patron has finished eating, the used dishes may be slipped through a trap door under the counter. These dishes fall on a rubber belt and are returned to the kitchen, where the belt runs through an automatic dish washing machine in which they are also automatically dried. They then are rolled off the belt into large baskets ready for replacement on the food belt or putting away.

The food conveyors, after passing through the dining room, are lowered to the next floor where another counter is provided, and more patrons are served as the trays pass before them on the return journey (*Continued on page 641*)

Page Maggie Jiggs!

By S. R. Winters

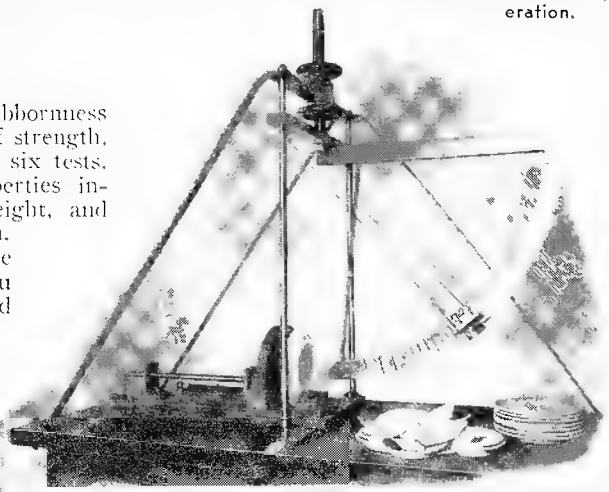
THE quips and cartoons about dinnerware as missiles hurled between wife and husband are proverbial. More than once Maggie (of cartoon fame) has used Jiggs' head as a battering ram, splintering chinaware into smithereens. In real life—in the research laboratory, at least—breaking chinaware, to test its strength, must be done systematically, and without the fickle human equation. Therefore, Uncle Sam has designed a sort of mechanical dummy for breaking dinner ware—and the proverbial bull in the china store is a tame affair compared with the reckless abandon with which this device shatters the dinner dishes.

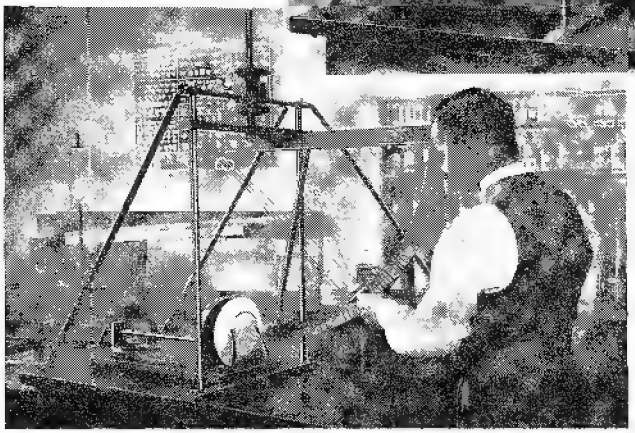
Exerting the force of a swinging pendulum, a "mechanical man" designed by the Bureau of Standards determines the strength of chinaware by destroying it. This pendulum, simulating the swinging arm of a person, delivers blows of increasing force until the test specimen breaks. The cumulative effect—or striking blows with increasing force—is measured by the weight of the pendulum and the distance through which it falls. The chinaware subjected to such merciless blows undergo two principal tests—its resistance to impact or direct blows and its relative stubbornness to chipping. As a merit of strength, the ware must submit to six tests. The other physical properties inquired into are size, weight, and amount of water absorption.

Curiously enough, the experiments of the Bureau of Standards have failed to disclose any definite relationship between the thickness of chinaware and its strength. Similarly, there is an absence of relation between the amount of water that has been absorbed by the ware and its strength. Furthermore, a piece of dinnerware may be subject to ready chipping and yet with-

(*Continued on page 641*)

Here's the "mechanical man" which tests the strength of chinaware by destroying it. Below —The machine in operation.





New Light on Old Masters

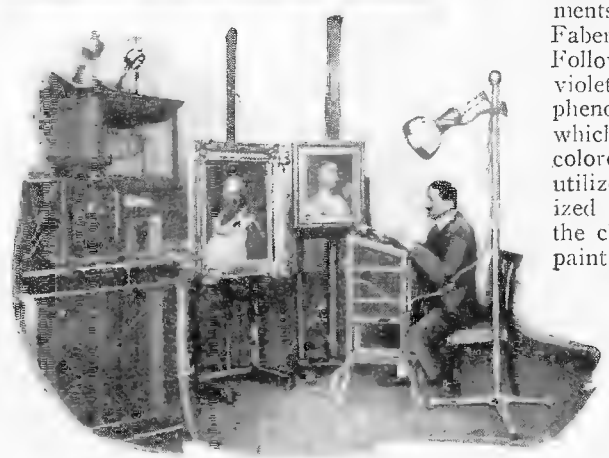
By Jacques Boyer
Translated by T. O'Conor Sloane, Ph.D.

How the X-Ray and Ultraviolet Ray Are Being Used to Make the Falsification of Ancient Paintings Impossible

Right—The famous "Benedicité" of Chardin, photographed by white light. Above—A portion of the same picture, under the X-ray, revealing the composition of the colors used by the painter, and the delicacy of his touch. The X-ray unerringly detects any attempt to duplicate the Chardin style.

ART critics and the most accomplished antiquarians can find in chemical or physical tests most valuable means of verification in determining the authenticity of a picture, even if it carries the signature or mark of a distinguished painter. To satisfy the market provided by amateurs and collectors, how many skillful falsifications have been produced of *"chefs-d'oeuvres"* of the virtuosos of the brush! But today the authorities in the museums are losing confidence and the same applies to amateur collectors. Today, before accepting a picture, they have the colors analyzed by chemists and the technique examined by artists, while physicists examine it for retouching, restorations, or evidence of counterfeiting.

In the course of the year 1928, H. H. Verne, director of the French national museums, put into the hands of J. F. Cellerier, director of the testing laboratory, Conservatoire des Arts et Metiers, Paris, the work of establishing in the museum of the Louvre a laboratory of scientific research, in which the technique of paintings could be studied, and the identification of pictures and works of art carried out. M. Cellerier started with a small installation, enabling him to apply all the resources of physics and chemistry to determine the exact composition of substances employed on a picture and to study the special technique of each artist. The eminent scientist and his assistants proceeded step by step to make the most varied tests to carry out their investigation. They utilized X-rays, already employed for a number of years for these experiments by such investigators as Faber, Heilbron and Dr. Cheron. Following Bayle they used ultraviolet rays on account of the phenomena of special luminosity which they produce on certain colored pigments. They also utilize the spectroscope, polarized light, and the analysis of the chemical constitution of the paint and of the support; all of which gives the most valuable indications for a report on the picture examined. Thus these methods of scientific examination complement each other.



Above—The interior of the scientific research laboratory established in the Museum of the Louvre, showing a part of the equipment.

M. Cellerier and his collaborators are actually preparing this "Reference of Artists' Technique" by determining the technique and the characteristic (*Continued on page* 642)

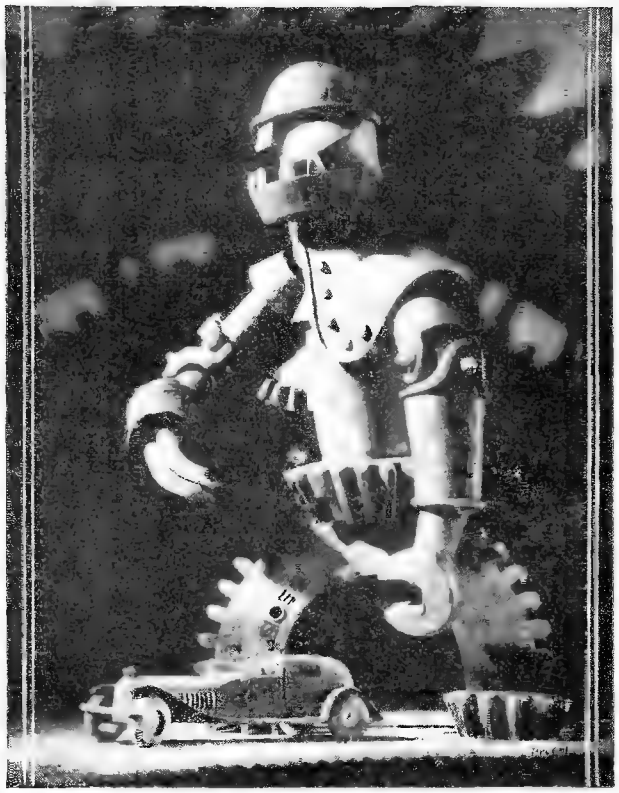
At the right is shown how the X-ray separates the original part of a painting from the restored part. The painting as restored appears at the left. Water colors were used in the restoration of the picture.

This painting of the Bruges School appeared uniformly ancient under the camera as ordinarily operated. The X-ray detected signs of retouching at the base of the neck and on the cheek, as shown at the right.

Man-made Models Enter Advertising Art

By Eugene de Lopatecki

Willy Noell, German Artist, Has Worked Out a Technique for Making Advertising Illustrations by Photographing Ingeniously Constructed Miniatures in Plasteline

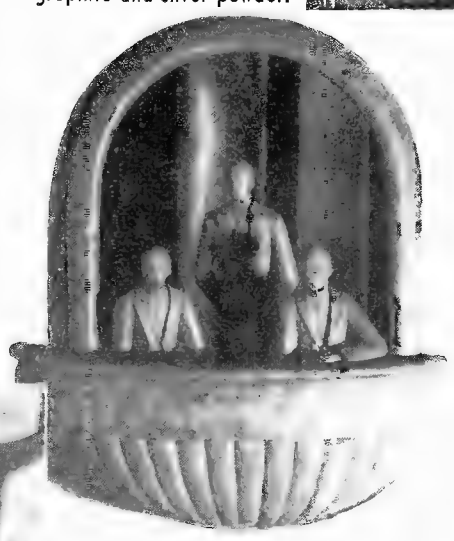


Skeleton, armor, gear teeth, cams, and other auto parts that comprise the "Machinery Demon" of iron? Guess again! They're all of clay, dusted with a combination of graphite and silver powder.

THE "Machinery Demon," in his stiff and clanking metal armor, is just a plasteline model, about four inches high, skillfully photographed. And the dainty miss selecting a cigarette is not a human being at all; she is a combination of cardboard, wire, plasteline, and paint, treated in the same manner. The only real thing about the figure is her cigarette case.

The figures accurately proportioned? Lifelike? Yes—for the innovator of this latest development in advertising art—photographing miniature clay models instead of live artists' models—is himself a well-known artist.

Willy Noell recently arrived from Germany. He had been interested in the movies—had seen miniature movie sets. Trees from sponges. Falls of cardboard. Why not camouflaged models for advertising illustrations, following the same plan? They would certainly be more economical than staging elaborate posings of flesh-and-blood models. And how much easier to arrange, work with, and change! How much more distinguished the effects! If you didn't like a nose, you just remolded it! If you wanted more shadows and highlights, you rubbed the corners with a soft rag.



Three clay gentlemen, "The Distinguished Set." The balcony is strong cardboard covered with Plasteline. "Three Distinguished Gentlemen" fencing in real life would have made a rather ordinary picture. In clay, the result is really distinctive.

So—Mr. Noell began experimenting with miniature figures of plastic material, wood, wire and cardboard. After completing one, he had it snapped by a good photographer—and there was the illustration, ready for use.

Take the mechanical robot, used for a Whiz Oil advertisement. Various attempts to build this monster of motor parts had proved unsuccessful. For you cannot model figures of steel in exact proportion, with subtle shadings. Since steel is not plastic unless melted (and then it's too hot to work with), it cannot be cut or molded for art work.

Mr. Noell solved the problem. He fashioned and implanted a skeleton of strong wire in a wooden base, just about the size of the model needed. Upon this foundation he molded a robot of plasteline (regular sculptor's clay). He was able to get the gear teeth and armor details in exact scale. But a steel model, not a clay one, was required. A mixture of graphite and silver powder, dusted on the figure, did the trick. To get highlights and shadows, breaking the monotone, the artist wiped the edges with a soft rag.

Here the photographer helped; the success of a (*Continued on page* 658)

Her hat is not of felt, her ears are not of cartilage, her wrap is not wool. The only thing that's real about her is the cigarette case. To add to the depth of the relief the background was painted black.

Mechanics, Manual Training Students, Home Handicraftsmen

Get Your Share of $3250.00

in Fine Tools and Home Workshop Equipment

In Fifteen Minutes You May Win a Complete Workshop of Your Own Selection

IF YOU HAD $50.00, or $200.00, or $400.00 to spend in equipping a home workshop, what tools and equipment would you buy?

SCIENCE AND INVENTION will award $3,250.00 in fine tools and home workshop equipment to the fifteen people who answer this question most effectively in the judgment of a picked committee.

There are no strings attached. You invest nothing but the price of stamps and stationery, plus the mental effort of selecting and listing the tools and equipment you think are best.

The Three Points

There are three points to consider —QUALITY, COMPLETENESS, AMOUNT OF MONEY ALLOWED.

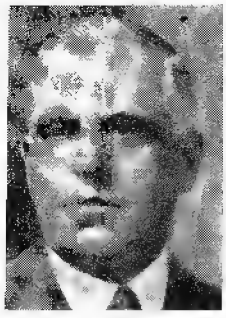
You want your assortments to be as complete as possible. But completeness must not be gotten at the sacrifice of quality. And the cost of any assortment must not exceed the amount of money allowed.

Your problem, in a nutshell, is to balance QUALITY against COMPLETENESS and both of these points against the AMOUNT OF MONEY ALLOWED. . . . The fifteen prizes, totaling $3,250.00 in fine tools and workshop equipment, will go to the fifteen people who tell us how to get the MOST and BEST tools and equipment for the AMOUNTS OF MONEY named in the three price divisions. You may enter lists for any or all the divisions.

Each winner in the contest will receive exactly the tools and equipment he has named in his winning selection. . . . *If, however, his winning selection duplicates tools or equipment he already owns, we shall be glad to substitute any others he may desire in their place, provided the total cost is the same.*

Ask Us for Catalogues

We want all the data we can get on the ideal tools and equipment for the home workshop. To help you in making out your lists, we shall be glad to see that you are supplied with a representative group of manufacturers' catalogues. Drop us a line saying you wish to enter the contest. We'll do the rest.



Presenting the Judges

Robert Henry Smith, M.S., is Associate Professor of Machine Construction at Massachusetts Institute of Technology. For forty years he has had charge of the Machine Tool Laboratory there.

Alfred S. Kinsey has been Professor in Charge of Shop Practice at Stevens Institute of Technology, Castle Point, Hoboken, N. J., since 1908, and is a member of the American Society of Mechanical Engineers.

Arthur H. Lynch, Editorial Director of the Radio-Science Publications, will serve as the third member of the judges' committee.

Three Divisions—Fifteen Prizes

Five at $50.00

In the First Division you select the ideal tools and equipment you would buy if you had $50.00 to spend.

The prizes in this division will be five sets of tools and home workshop equipment, costing $50.00 each at the manufacturers' list price. Tools and equipment will be exactly those selected by the winners.

Five at $200.00

In the Second Division you select the ideal tools and equipment you would buy if you had $200.00 to spend.

The prizes in this division will be five sets of tools and home workshop equipment, costing $200.00 each at the manufacturers' list price. Tools and equipment will be exactly those selected by the winners.

Five at $400.00

In the Third Division you select the ideal tools and equipment you would buy if you had $400.00 to spend.

The prizes in this division will be five sets of tools and home workshop equipment, costing $400.00 each at the manufacturers' list price. Tools and equipment will be exactly those selected by the winners.

How to Do It

GET A REPRESENTATIVE GROUP of tool and equipment manufacturers' catalogues. Pick manufacturers who make tools and equipment of established quality, reputation, and dependability.

Write down the names of the tools and equipment units you think would be ideal for the home workshop in any or each of the three price classes named, together with the manufacturers' list prices. Try to make your assortment or assortments as complete as possible within the money limit allowed. Enter lists for any or all of the divisions as you please.

For each list write a letter of from 200 to 500 words, telling plainly why you chose the tools you did. Send in the letter with the list. The letter will be considered by the committee in making the awards. Give reasons that are to the point.

Winners in the Ideal Home Workshop Equipment Contest will be announced in the April, 1931, number of SCIENCE AND INVENTION.

Your Hardware Dealer Will Help You

Thirty-five thousand hardware dealers have been informed about this Ideal Home Workshop Equipment Contest. They will be glad to cooperate with you in selecting the tools and equipment for your Ideal Home Workshop list or lists. Ask your own dealer about it.

Follow These Simple Instructions

A List your ideal tools and equipment with manufacturers' names and list prices, keeping the total within the amount named in the division the list is intended for.

B Write a letter of from 200 to 500 words explaining why you chose the tools and equipment you did.

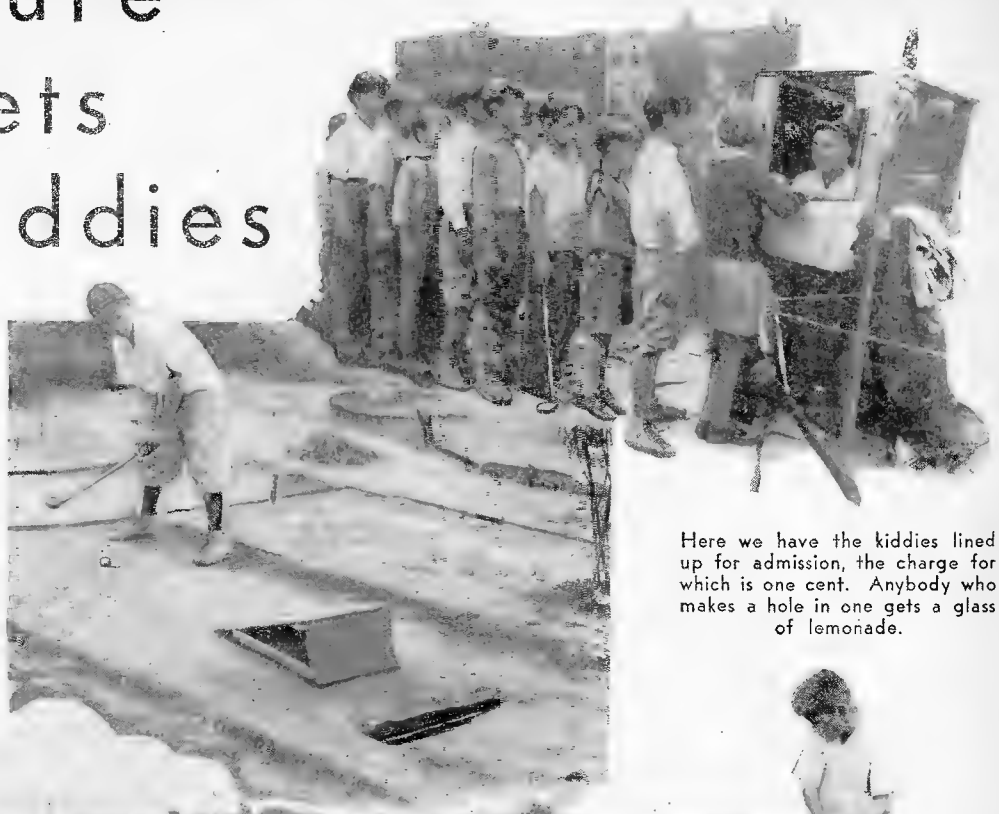
Contest Rules

1. Entries must reach our office, 381 Fourth Avenue, not later than midnight, December 24, 1930.
2. Only one prize will be awarded to any winning contestant, but you may enter lists in any or all the divisions.
3. The contest is free and open to everyone. You need not be a reader of SCIENCE AND INVENTION to enter.
4. In case of ties, tieing contestants will receive prizes of identical worth according to the division involved.
5. Neatness of lists and pointedness of letters will count in the awards.
6. No employees of this magazine or members of their families are permitted to enter the contest.
7. The decision of the judges will be final.
8. The winning lists will be those in which completeness and quality are best combined, in the judgment of the committee, within the money limits of the divisions involved.

Machine Tools, Motors, and Miscellaneous Working Equipment Will Be Considered in this Contest

Miniature Golf gets the Kiddies

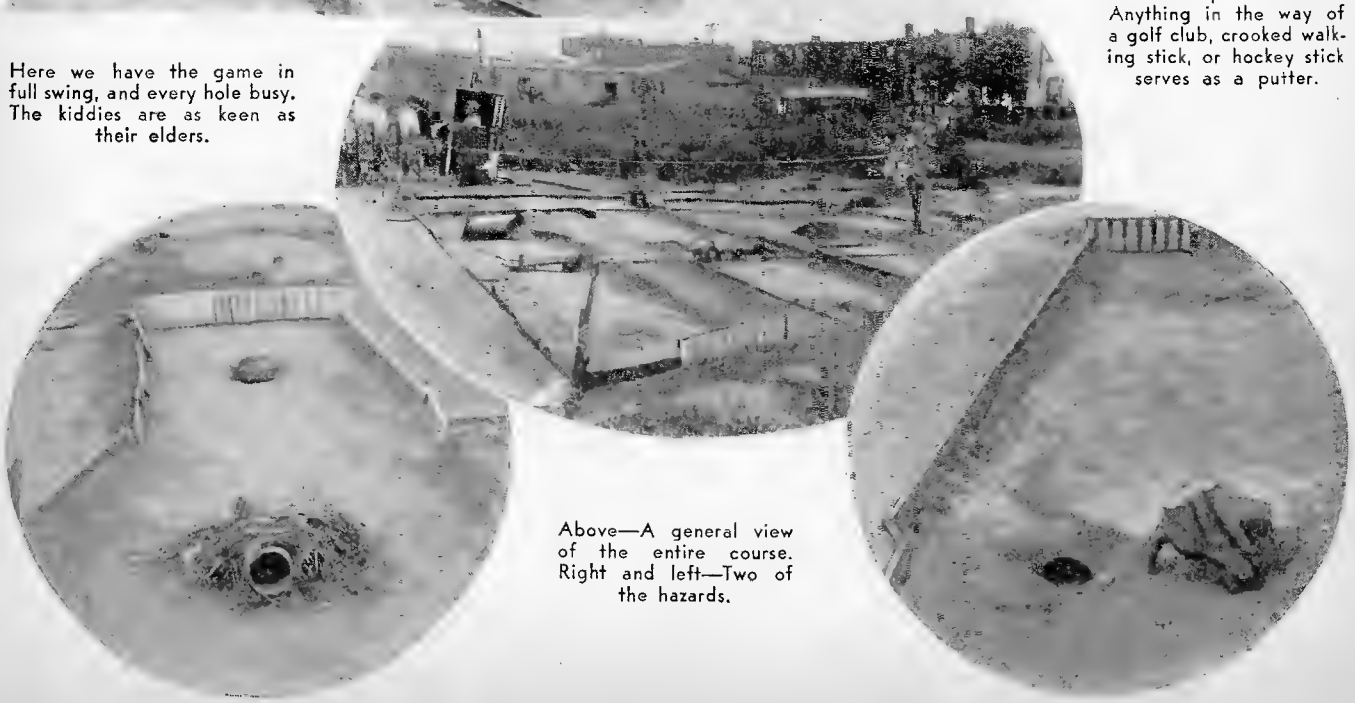
No One, Apparently, Is Safe From the Miniature Golf Bug Nowadays. Even the Neighborhood Kiddies of the Long Island Suburbs Have Been Bitten. Here Are Some Photographs of a Primitive Course They Have Laid Out in a Vacant Lot at the Corner of Metropolitan and Flushing Avenues, Queens. A Strip of Rolled up Linoleum, Bits of Piping, Tree Roots, and What Have You, Serve as Hazards.



Here we have the kiddies lined up for admission, the charge for which is one cent. Anybody who makes a hole in one gets a glass of lemonade.

This is a mean hole. Will the "south paw" make it? Anything in the way of a golf club, crooked walking stick, or hockey stick serves as a putter.

Here we have the game in full swing, and every hole busy. The kiddies are as keen as their elders.



Above—A general view of the entire course. Right and left—Two of the hazards.

A Billion Dollar Business in Junk

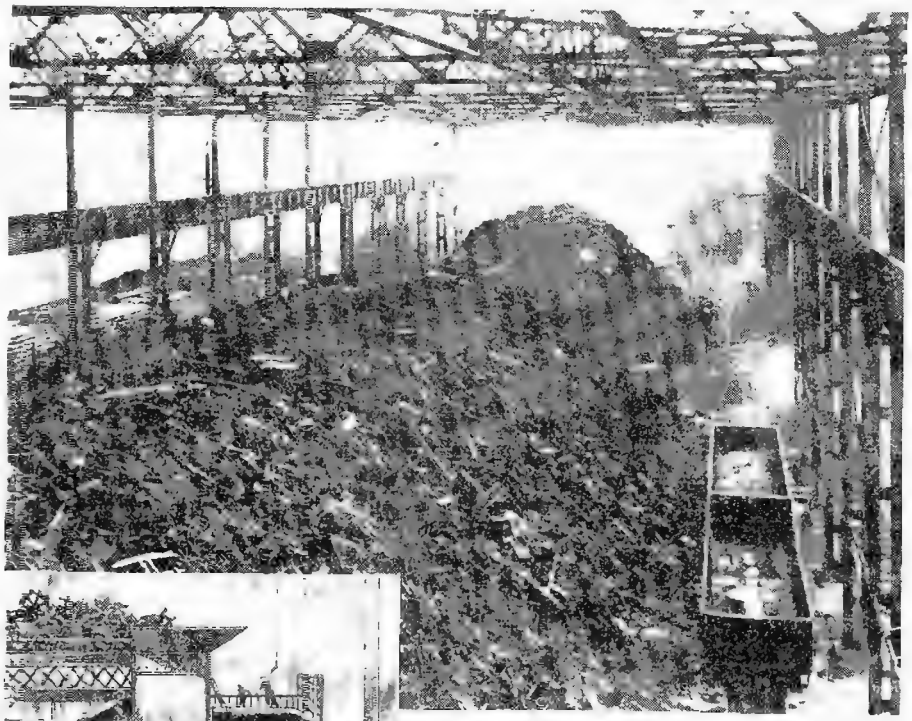
By Leon D. Wilkins

MOST of us are familiar with the fact that old automobiles eventually find their way to the junk man, that scrap iron is melted down and used over again, and that old newspapers, magazines and rags go to make new paper. But how many of us are aware that the junk business is now a highly organized billion dollar industry, the raw material for which is provided by the waste products of a thousand other industries and human activities? The machinery of this industry literally absorbs otherwise worthless junk at one end and delivers dollars and cents at the other.

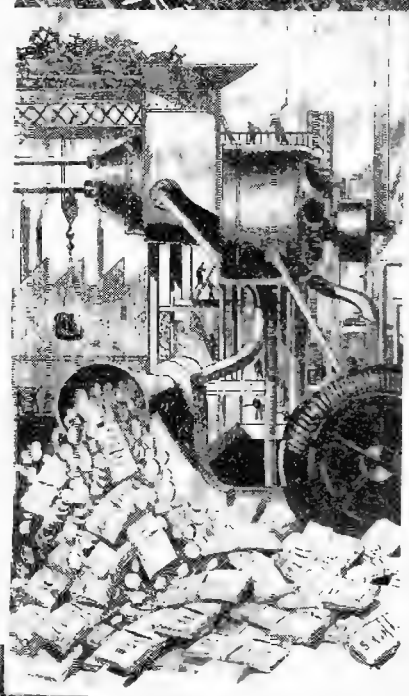
At least half a million dollars' worth of scrap iron and steel is reclaimed annually, and more than 30,000 tons of such material is consumed each year at furnaces, mills and foundries, according to the United States Bureau of Mines. The value of other common metals reclaimed amounts to more than a quarter of a billion dollars.

According to the definition of the Bureau of Mines, secondary metals are those recovered from scrap metal, sweepings, skimmings and drosses. They are so called to distinguish them from metals derived directly from ores, which are called primary metals. The distinction does not imply that secondary metals are of inferior quality, for metals derived either from ore or waste material vary in purity and adaptability to use in making certain products.

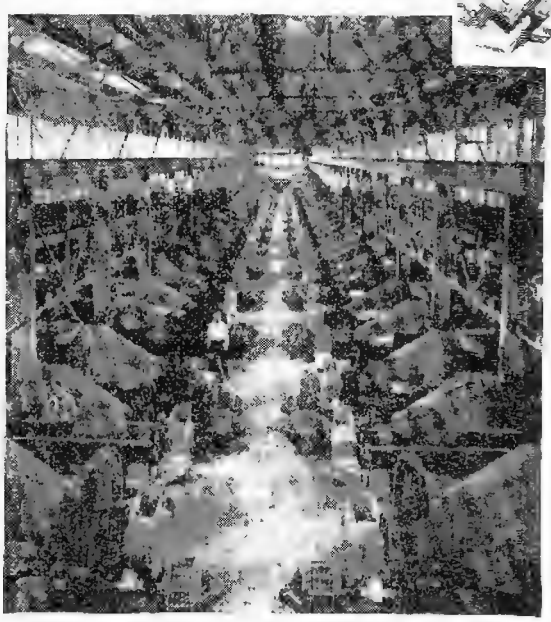
"The collection of waste material is a long-established branch of industry now vital as a source of supply of many products," says J. P. Dunlop in a statistical report recently published by the Bureau of Mines. "The problems connected with the waste trade are no longer viewed academically by the large consumers of metals and other wastes. They are an important factor in the supply of raw material, and their proper use results in reduced cost of many products. The interest shown in problems connected with metal wastes and their recovery and use continues unabated. Old trade associations are enlarging the scope of their activities and new ones are being established. Associations to perform service for the lead and aluminum industries similar to the service rendered by the Copper and Brass Association have been formed. All these associations seek to standardize specifications."



This picture shows piles of scrap iron waiting to be put into the open hearth furnaces of the Open Hearth Steel Mfg. Co. at Steubenville, Ohio



"The junk industry absorbs junk at one end and delivers dollars and cents at the other"



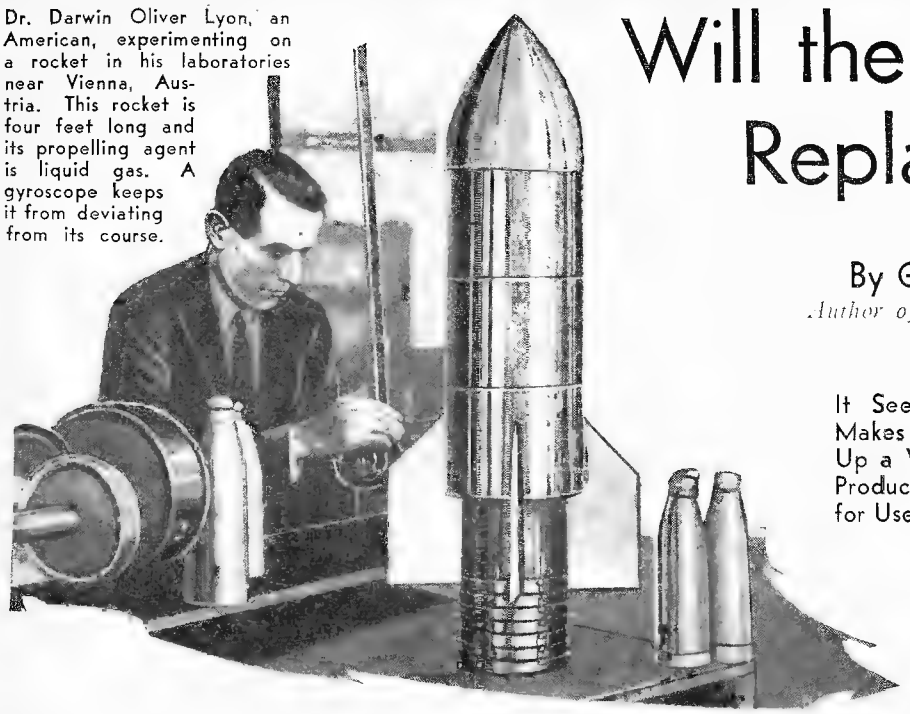
Sixty-four grinders at work at Lake Linda, Mich., on ore formerly regarded as waste

Photos Ewing Galloway

Under present economic conditions only a small percentage of the waste paper, rags and metals discarded at homes now returns to the waste trade; high collection costs preclude rural collection in small quantities.

Jewelry and dental waste furnish the largest supply of secondary gold and silver, and photographic waste also provides a vast quantity of secondary silver. The recovery from waste film is probably 800 ounces to the million feet. The largest plants engaged in recovering silver from films are located in Denver, Los Angeles and San Francisco.

In Nevada, about 15,000 pounds of mercury are being recovered annually from old dumps and slimes at mills which formerly treated gold and silver ores by amalgamation. More than 500,000 short tons of secondary copper are recovered every year in the United States, also 300,000 short tons of secondary lead, which is equal to 40 percent of the total refined primary lead produced. About 70,000 short tons of secondary zinc is recovered, and the recovery of secondary tin is equal to about 41 percent of imported tin and is valued at between $35,000,000 and $45,000,000 annually. Most of this tin is obtained by detinning old tin-coated containers. Western copper mines use detinned scrap to precipitate copper from mine waters.



Dr. Darwin Oliver Lyon, an American, experimenting on a rocket in his laboratories near Vienna, Austria. This rocket is four feet long and its propelling agent is liquid gas. A gyroscope keeps it from deviating from its course.

Will the Rocket Replace Artillery?

By Gawain Edwards
Author of "The Earth Tube," etc.

It Seems Inevitable That Whenever Science Makes Some New Advance, Somebody Thinks Up a Way of Utilizing the Latest Discovery to Produce Still Another Engine of Frightfulness for Use in Time of War. Much Has Been Heard Recently of the Adaptation of the Rocket to the Peaceful Arts. Here We Have the Other Side of the Picture—the Potential Horrors of the Rocket as an Alternative to Artillery

SO many forecasts of the horrors of future war have been made in recent years that military engineers will probably require a long time to work out all the devices that have been suggested to them by imaginative writers and speakers. But recently an authentic touch of frightfulness was added to these forecasts when it became known that the war departments of several European countries, notably Germany, France and Italy were making special and secret studies of rockets to supplement or replace cannon in bombardment and barrage.

What this may mean in terms of military and civilian slaughter in time of war can hardly be imagined. The big gun has grown from the old-fashioned iron cannon to the Big Bertha that bombarded Paris, but this is about the ultimate range of such weapons. As long as no other type of projectile throwing arm is used there is little danger that New York, for instance, can be blown to pieces by batteries placed at Paris or Berlin. The mechanical difficulties preclude forever the throwing of explosives such distances by cannon.

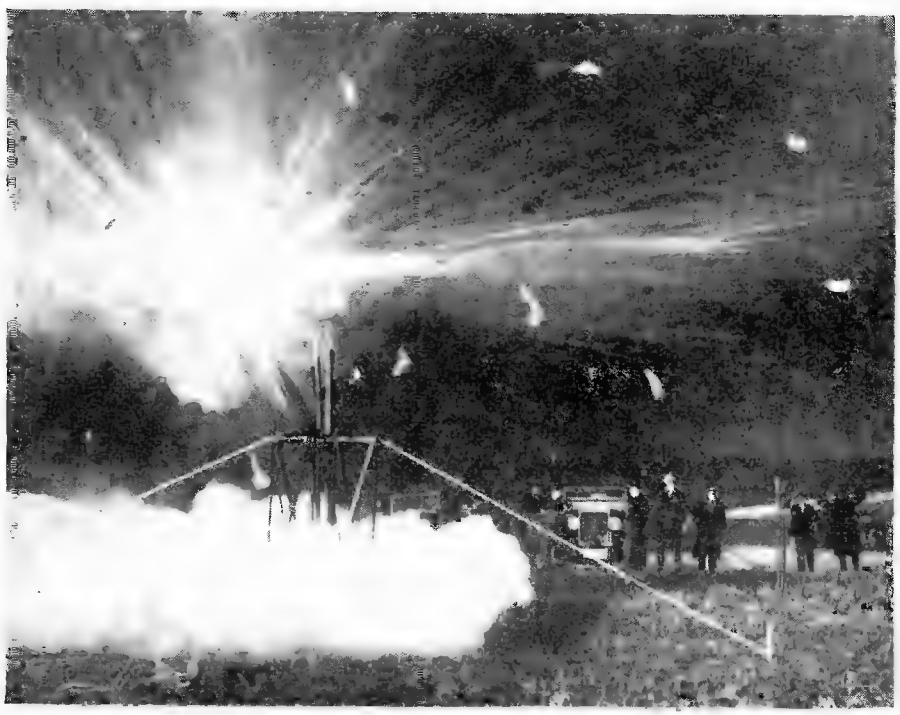
But in modern rockets we have a new and almost untried weapon that may revolutionize warfare, make possible the accurate bombardment of cities half way around the earth, turn every infantryman into a traveling artilleryman, and carry the battle beyond the front-line trenches into the very homes of non-combatants and civilians in the capitals of the world.

Renewal of experiments to adapt rockets to the uses of war, recalls the fact that these devices have already had an important place in military history. Before 1805 Sir William Congreve, an unusual and versatile British inventor, suggested that rockets might be used to good effect in attacking cities, fortifications, or fleets of ships, and to him we owe much of our modern conception of the uses to which rockets may be put. Previously the rocket had been only a pretty product of the pyrotechnist's art, suitable for displays at celebrations. He perceived in the recoil principle that drove these fiery toys, a force that could be turned to the uses of mankind, and since England was at that time embroiled in wars across the channel, his mind naturally linked rockets with military operations.

Carrying on earlier experiments made by General Desaguliers at the Woolwich Laboratory, Congreve mastered the rudiments of rocket-craft, as it was understood in his day, and set himself to the task of making a rocket capable of carrying an explosive or incendiary charge and having a range of two miles or more. At length, he obtained permission for the construction of several rockets after his design in the Royal Laboratory. Military authorities were impressed and preparations were made to try out Congreve's scheme in actual battle.

When Sir Sidney Smith's expedition went against Boulogne in 1805 it included a number of boats equipped with rockets and apparatus for firing them. Congreve himself went along and participated in the subsequent attack against the French flotilla, but rough weather prevented the use of rockets in the battle. The following year however, they were used in another attack against Boulogne and were credited with doing considerable

(*Continued on page* 652)



This photo shows a slight mishap which occurred when one of Ludvik Ocenasek's rockets exploded at the starting point at Prague, Czechoslovakia.

How to Form an Outboard Club and Hold a Regatta

By J. Phillips Dykes

Rear Commodore and Secretary American Outboard Association

Miss Helen Hentschel, an American, passing the finishing post during an outboard race in Berlin in 1928.

THE enthusiasm for outboard racing seems to know no bounds! From all over the world, reports of stirring races come in almost daily. Records tumble at every new report and the motor manufacturers are toiling night and day to keep up with the demand for their products!

The first move in the forming of an Outboard Club is for some one sufficiently interested to sell the idea to fifteen or twenty more enthusiasts.

Then a meeting place must be selected, a vacant office, someone's store, a hall, or even the front porch will do -a temporary Commodore, Vice-Commodore, and Rear Commodore should be chosen, a name for the club suggested, cooperation of the American Outboard Association should be obtained by letter to its Secretary, and you are off to a lot of red-blooded fun and sport! The A. O. A. address is 11 West 42nd St., N. Y. City.

When these things have happened, a line or two to the writer will bring complete details on the constitution, by-laws, and functioning of the club. The duties of officers, committees and sub-committees and whatever additional information may be needed to give the new Outboard Club a proper send-off.

There are many towns on inland waterways, the seacoast or river bank where exciting and profitable regattas could be staged by local talent if the boys were familiar with the routine and detail of working committees for such events. It is to assist these groups that the following is offered.

First we must have a race course. Officially it should measure 2½ miles in circumference. However, with outboards and extreme manoeuverability, smaller courses can be used to great advantage though speeds will of course be reduced due to the sharper and more frequent turns. It is not advisable to make the course smaller than one mile, however, as speeds will be entirely sacrificed and the chance of accident increased many times over by the crowding that will ensue.

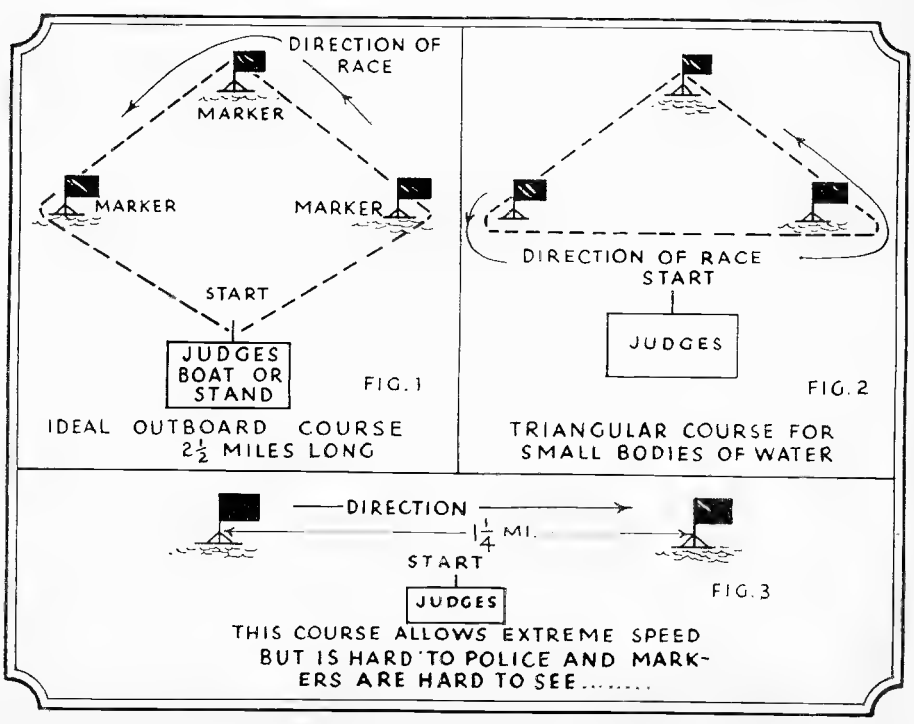
Fig. 1 shows the best method of staking the course. Course Fig. 2 is very spectacular due to the sharp turns but reduces speeds. The Fig. 3 course is the least satisfactory, as the distances between buoys is so great that many drivers lose sight of them and run off the course. Another fault in this course lies in the fact that there being no buoys in the center of the course, transient boats, cruising along and not seeing the end markers, often trespass, inviting accident and roughing the water as well as interfering with the spectators' view of the race.

Fig. 4 shows an easy way to construct markers. These are simple and a few minutes' work with hammer and saw will suffice for each one.

The ideal arrangement for the judges' stand is flat bottomed scow or barge long enough and with enough beam to carry twenty-five men and necessary equipment. However, a large houseboat or cruiser can be used to advantage. Another excellent arrangement is the end of a convenient dock, especially if it happens to be T-shaped. The dock or barge arrangement is fine where the clock system of starting is used, but the boat can be used equally as well if flying starts as used by the Mississippi Valley Association are adopted.

The clock system is troublesome, cumbersome, and apt to confuse drivers, so is seldom used except at National regattas. For the small club a flying start using the pole boat is to be recommended. No one but the race committee should be allowed on the judges' stand or in the poleboat.

An interesting program should include "A," "B" and "D" class races and a free-for all. (*Continued on page* 662)



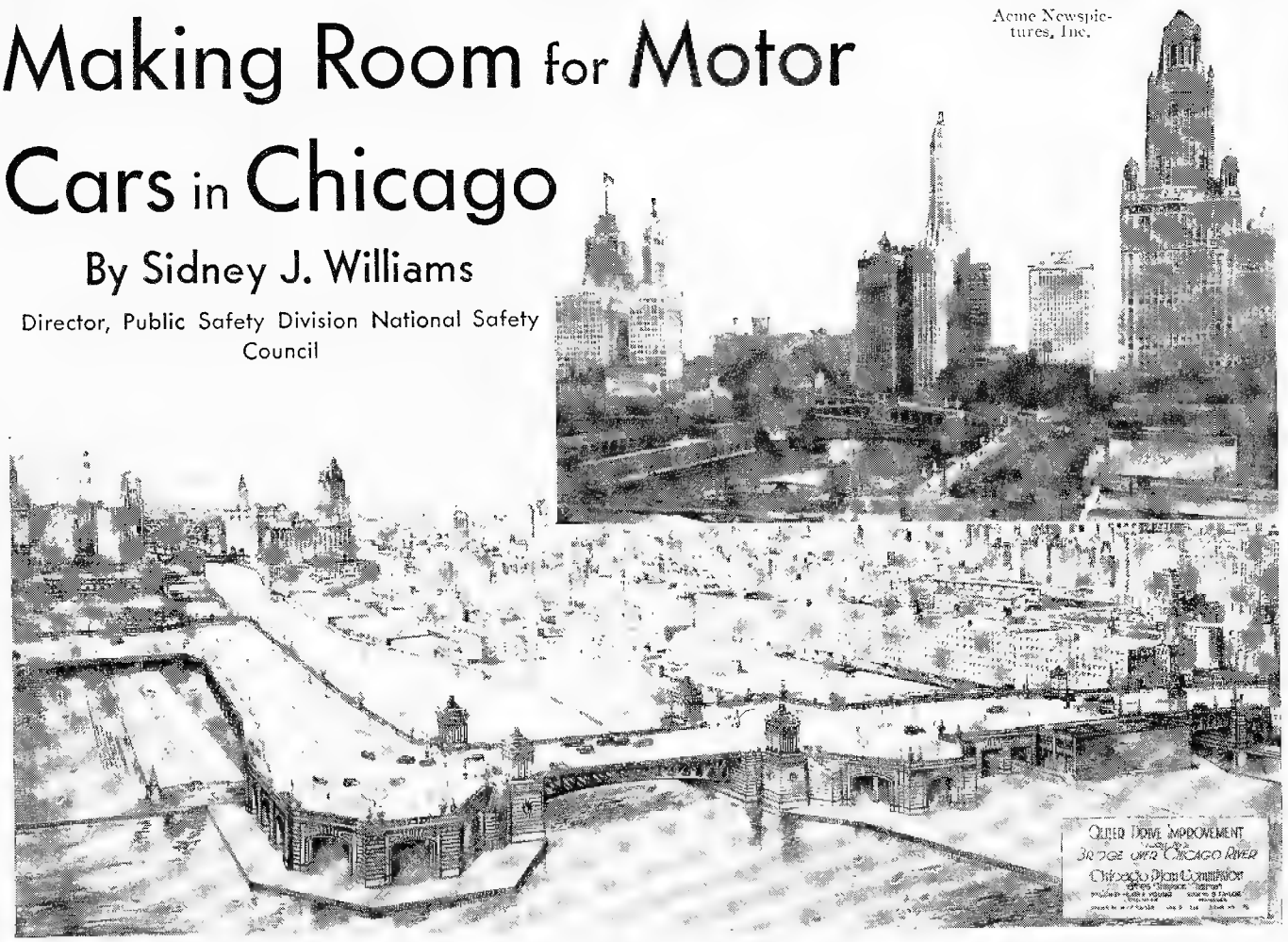
How to lay out different outboard race courses.

Making Room for Motor Cars in Chicago

By Sidney J. Williams

Director, Public Safety Division National Safety Council

Acme Newspictures, Inc.



The photograph shows Wacker Drive, double-deck improvement of the north boundary of Chicago's business district. Note raised double-deck bridge. In the drawing appears the final link in the Outer Drive.

THE location of Chicago along a lake shore has restricted the number of traffic arteries radiating from the business center. Naturally this has caused an overcrowding of these arteries, which serve a surrounding population of more than 4,000,000 people.

The probable future growth and traffic needs of the metropolitan area formed a major problem in the Chicago Street Traffic Survey, conducted in 1926 for the Chicago Association of Commerce. One of the results of this survey was a plea for the uniform treatment of traffic problems throughout this entire region.

This also has been the viewpoint of the Chicago Regional Planning Association, in its efforts to better traffic conditions, and of the Municipal Plan Commission as well.

The problem of providing adequate approaches to the central "Loop" district has caused Chicago to pioneer in the development of "through streets," and of extensive systems of automatic traffic lights.

It also has stimulated the city to plan a unique system of parks and "outer driveways" along the 22 miles of lake shore within the city limits.

The largest of the parks, extending almost continuously along the lake shore, were made possible by state laws enabling the city park boards to exchange designated areas of newly filled lake shore land for the riparian rights of private owners. Thus the park boards were able to extend the new park areas and the new driveways into the former bed of the lake. This has made possible the planning of a practically continuous new driveway along the entire water front.

WACKER DRIVE

WACKER DRIVE is the designated name for the improvement of the northern boundary of the traffic quadrangle around Chicago's central business district, formerly one of the most crowded in the city.

The improvement includes two levels, one street above the other. The upper level is 110 feet wide for general traffic, and the lower level is 135 feet wide for the exclusive use of heavy commercial traffic which passes between the boat and freight terminals and the industrial district east of Michigan Avenue and the warehouse, industrial and terminal district on the west side. Vehicles can pass six abreast, three lines in each direction, without interruption from cross traffic.

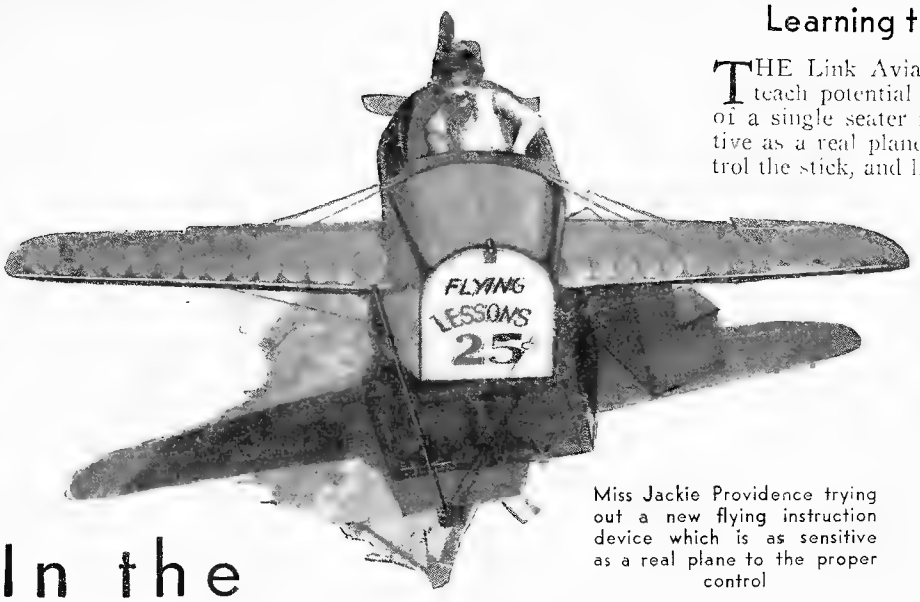
Approximately 25 per cent of the population pours in and out of the "Loop" every day, between the hours of 7:00 a. m. and 7:00 p. m. The Loop traffic problem has long been a serious one. One of the first important steps toward its solution was the widening of Michigan Avenue, which extends through the Loop district along the former lake shore. In 1924 the surface street car lines co-operated by re-routing many of their car lines to eliminate left turns and most right turns at busy intersections. This move proved so beneficial that the City Council prohibited all left turns by vehicles in the Loop.

Another important step came in 1926,

(*Continued on page 665*)

Thousands of Chicagoans can park their cars in the Grant Park municipal area, within a few minutes' walk of the loop skyscrapers.

Learning to Fly While on the Ground



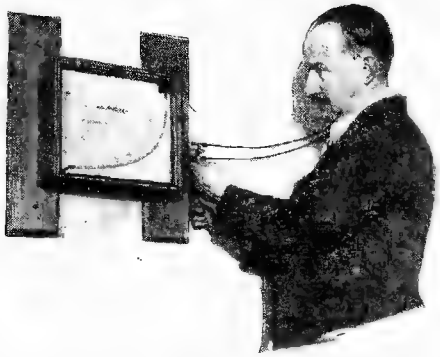
Miss Jackie Providence trying out a new flying instruction device which is as sensitive as a real plane to the proper control

THE Link Aviation Trainer is the name of a device to teach potential aviators the art of flying. This consists of a single seater monoplane-like structure that is as sensitive as a real plane. If the operator does not properly control the stick, and have the ailerons and rudder in the correct position, all of the sensations of a side slip, nose dive, or a near loop are experienced. An electric motor supplying air to a bellows, produces the flying effect. A small light on the nose of the plane indicates to the ground pilot when the stick has not been properly controlled, while an indicator tallies every error. The device is the center of attraction at the Mayfair Miniature Golf Course in Los Angeles, Calif., where it was first installed. Such devices would make a valuable adjunct to the multitude of miniature golf courses that now dot the country.

In the Spotlight of Science

Measuring the Velocity of Winds

A WIND meter which is said to be capable of recording the velocity of wind at all speeds of from one to eighty miles an hour, and to indicate any variations in this velocity, has been invented by R. E. Apthrop, of Salem, Mass. A colored liquid in a glass tube moves back and forth in response to the force and fluctuations of the wind. According to the inventor, the device can be built at the surprisingly low cost of $75.00 per unit, and would prove to be invaluable for ships or planes.



World's Record for Consecutive Airplane Takeoffs and Landings

WHAT is believed to be a world's record for consecutive takeoffs and landings in an airplane has been established at the Akron, Ohio, municipal airport by Pilot "Wildbill" Hudson of the Goodyear Tire & Rubber Company, who made 489 separate flights between 5:00 A.M. and 7:45 P.M. in a single day.

The record was not established as a "stunt," but was all a part of the day's work for Hudson, whose job just now is testing a new type of brake for Air-wheels recently designed by Goodyear.

The plane, which was brought to a dead stop with full brake on each landing, made a complete 360-degree turn on each flight. Average duration of flights was 1 minute and 20 seconds. The ship is a standard Challenger Robin, and was used in development and demonstration of Air-wheels. Since that time it has made more than 4500 landings, 3000 of which were with rigid landing gear, without shock absorbers.

Electricity Lowers Life Boats

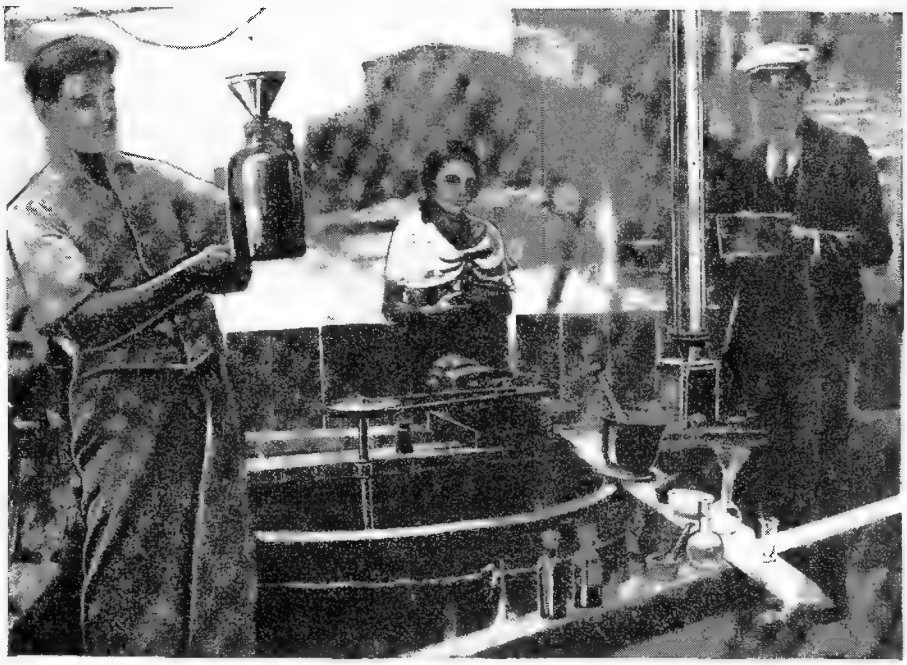
TO assure safety to passengers in time of distress, an electrically operated life boat lowering apparatus has been installed on board the Grace liner Santa Barbara. In the first test of the device in Brooklyn, N. Y., stewardesses of the liner demonstrated the practicability of equipment, and the ease with which it can be handled. Here we see the boat just touching the water after being electrically lowered. It is at all times under complete control.

Lightweight Motor for Launching Gliders

L. V. HUBBARD, of Los Angeles, Calif., has invented a new six-cylinder radial motor, which is intended for launching gliders. While the motor weighs only fifteen pounds, it will develop 4½ h.p. Another smaller motor weighing but four pounds also develops sufficient energy to launch gliders, and it has been claimed that with a seven-pound tank of carbon dioxide gas, this smaller motor will launch a glider twenty-five times and do away with the elastic bands and the numerous helpers that are now needed. Provision has been made for the use of gasoline.

L. B. Hubbard demonstrating how a four-pound motor can drive a propeller at 1500 revolutions a minute, and a closeup of the interior of the radial motor

Will the Sea Yield Its Treasure?

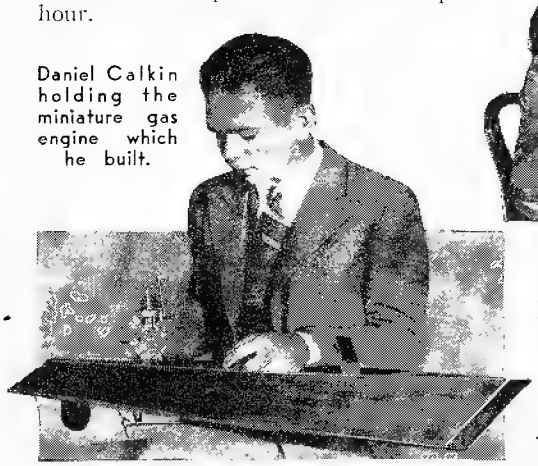


EXPERIMENTS completed recently at a seaside laboratory installed in a cabin at Las Flores Beach, Santa Monica, Calif., have convinced Herschel C. Parker, consulting mining engineer, and his partner, Konrad Kather, of Berlin, that gold can be obtained from ocean waters in paying quantities. It is a well-known fact that the waters of the ocean contain gold. The cost of extracting this gold has heretofore been so great as to prevent commercial efforts. According to Parker, tests have shown that his new process can earn better than 75 percent gross profit, and can extract gold on a basis of two cents value from between five and ten tons of sea water. Briefly, the process is supposed to operate along these lines. Sea water is piped into a tank, in the bottom of which tank an ochre-oxide of iron has been placed. The gold is supposedly deposited on the ochre, and is then put through an ordinary chlorination or cyanide process for extraction. Parker says that the chemicals are reclaimed and the process repeated.

The photo shows Kather, his daughter Bertha, and Parker in their beach plant where the experiments were conducted.

World's Smallest Gasoline Engine Drives Model Boat

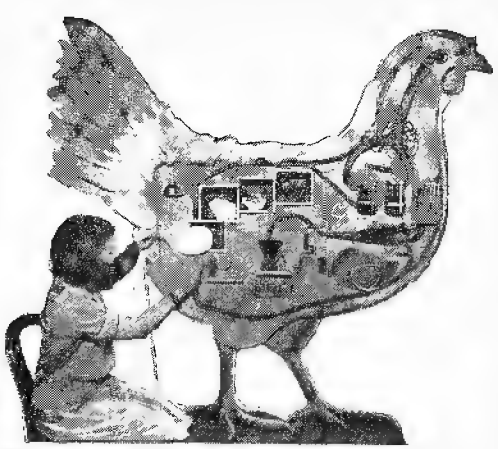
HERE is a vest pocket edition of a heavy duty, one-cylinder marine engine, which Daniel Calkin, a student at the University of Washington, built. It drives a forty-inch model boat. Ten weeks of labor were spent in building the tiny engine, which has a three-quarter inch bore, a one-third cubic inch piston displacement, and develops one-sixteenth of a horsepower. It propels the boat at a speed of four miles per hour.



Daniel Calkin holding the miniature gas engine which he built.

Talking Hen for London

A SEVEN-FOOT hen, speaking English, French and Spanish and laying wooden eggs, has been



built by the Department of Agriculture for exhibition at the London Poultry Congress. Various anatomical functions are performed and illustrated in a realistic manner while a phonograph supplies a lecture. This photograph shows Mrs. Margaret Roller putting the finishing touches to the bird.

News Later Than the Latest

THAT bright London evening paper, *The Star*, has found a way of achieving such a seemingly impossible feat, which is now being accomplished regularly by its "Stop Press" van. This unique vehicle carries a mobile printing press, by means of which it can "fudge" (print in the Stop-Press column) the very latest news received by phone from the office. The equipment comprises a complete composing frame and type cases, and a suction-fed Bush printing machine, capable of printing anything up to three 30-line fudge boxes at once at a speed up to 10,000 copies an hour. A Petter two-stroke engine provides the power for the printing press.

To still further increase the attraction and usefulness of this van, it has just been equipped with a special Marconiphone amplifier and two Marconiphone public address loud-speakers, through which can be broadcast microphone announcements and phonograph music as desired.

Special Sextant for Use on Airplanes

Capt. John Larson with his airplane sextant.

WHAT is claimed to be a perfect sextant for the use of pilots of airplanes has been developed by John Larson, a former sea captain now living in Chicago, Ill. Captain Larson has designed this device for taking reckonings, particularly on overseas flights. The desired angle is given by a pendulum device. Captain Larson developed this instrument while pacing the bridge during his many voyages about the world.

From Germany to New York by Air

IN a series of hops, Capt. Wolfgang von Gronau, an aviation instructor, and three companions, completed their trip from Germany to the United States by way of Greenland in 47 hours flying time. The flight was started on August 18th at the Isle of Sylt in the North Sea, the northernmost German territory, and ended at the Battery in New York City. The plane is an old Dornier-Wal that once served Capt. Amundsen.

A Beacon Both Day and Night

ON top of the LaSalle-Wacker Building, in Chicago, Ill., there is a new type of beacon which in the daytime reflects the sun rays, and at night reflects the light from neon tubes. The beacon was designed by A. N. Rebori, and differs materially from any now in use. It employs eight mirrors, three feet in width by five feet in height, and of parabolic cross section. Like a fluted octagonal column in shape, this aviation marker at night sends out beams of red light in eight directions. Two neon tubes of the hot cathode type developed in the research laboratory of the General Electric Company, and placed one above the other in the focal line of the eight mirrors, furnish the illumination. From above the beacon appears to be a huge eight-point red compass. The angles between the beams of red light are bisected by 2¾ million candle power beams of eight 24-inch searchlights.

Extracting Steel Fragments from the Eye

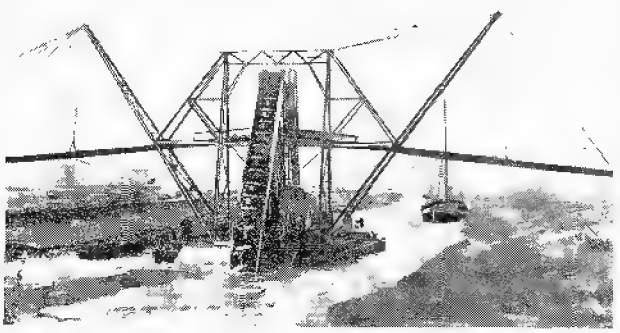
A POWERFUL electro-magnet has recently been put into operation in a Vienna, Austria, hospital for the purpose of extracting fragments or dust of iron or steel from the human body. In this photograph, we see the machine in use while extracting a splinter of steel from the eye of a patient. After the electro-magnet has been properly positioned, current is turned on. The piece of metal is removed with lightning rapidity, perhaps even faster than when it entered. This electro-magnet eliminates the necessity of delicate medical operations, and greatly expedites the recovery of the patient. It can be used for extracting any metallic particles of a magnetic nature from any part of the body. Results with it have been highly satisfactory to patients and practitioners.

Identification Marks That Don't Erase

NEW-BORN babies at the Delaware County Hospital, Pennsylvania, are now branded to prevent confusion, but the branding is not permanent, nor is it in any way harmful. The babies are exposed to ultra violet rays, a stencil being put on the back. The ultra violet rays give a sun tan mark, and the branding lasts for two weeks, at the end of which time the child and mother may leave the hospital.

Drying Up Zuyder Zee

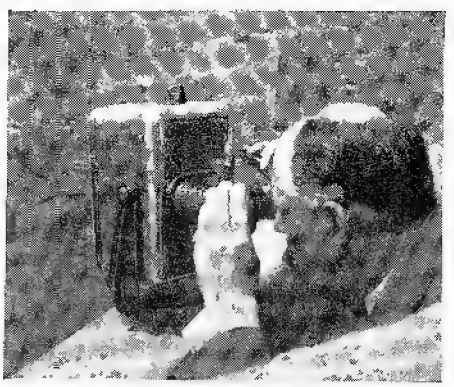
THE drainage of the Zuyder Zee has reached the stage where the bed is now visible. Two pumping stations were used in the draining, drawing off a total of 4,000,000 tons of water daily from the historic Dutch Sea, which has been completely dyked in. This is an area of 49,420 acres lying in the Northwest corner just inside the Island of Wieringen, where the former German Crown Prince passed his few years of exile. The area is expected to be dry by October. A little more than seventy-seven square miles of new land, most of it of the same rich heavy clay as the adjacent province of North Holland, will then have been won back from the sea and made into farms. This photograph shows one of the dredging mills.



Ten Cents a Look

AT first the heading above might sound a little ambiguous. Many a person has paid ten cents for a look at something or other. Here, however, is a new slot machine that has found its way to the top of one of Chicago's tallest buildings. It has converted the top of this structure to a dime arcade, and in some respects carries out the same old idea.

On the top of the Medinah Athletic Club, one is able to drop a dime in one of the series of binoculars, and the mechanism contained therein releases and opens up an avenue for a peep at Chicago. The binoculars are mounted on turn tables, so that a view of a quarter of the city can be obtained, and are also tiltable. This photograph shows John S. Fee seeing the city.

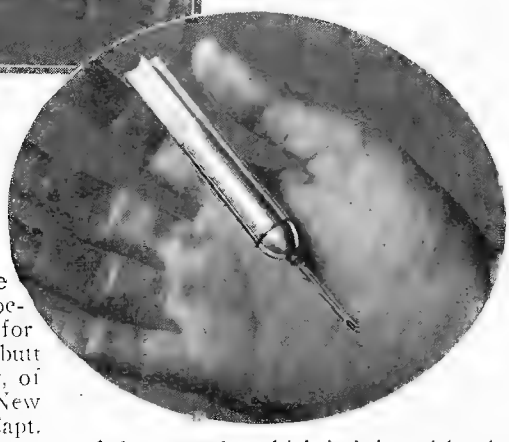


New Airway Radio Station

AN airway radio station that broadcasts weather information and emergency messages to airports and to aircraft in flight has been opened by the United States government at Silver Hall, Md. It operates on a frequency of 314 kilocycles with a power of 2000 watts, in conjunction with airway radio stations at Atlanta, Spartanburg, Greensboro, Richmond and New Brunswick. Weather information is collected by phone and automatic telegraph typewriters over an area of 400 miles.

Mercy Bullets Put Animals to Sleep

Capt. Barnett Harris demonstrating his invention of a mercy bullet with a lamb as a subject, and below, a closeup of one of the bullets.

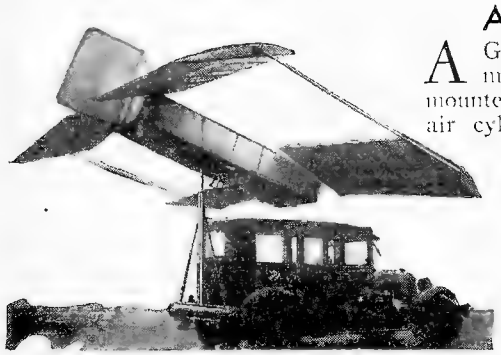


HUNTERS are now able to capture wild animals without injuring the animals, damaging valuable pelts and with absolute safety to themselves if they make use of the new mercy bullets recently invented by Capt. Barnett Harris, a former army captain, and now the head of the Harris Zoological Expedition. In demonstration tests for Chief Veterinarian Raymond Garbutt of the A.S.P.C.A., and Dr. Hatcher, of Cornell Medical School, at the New York Live Stock Exchange, Capt. Harris showed how a sheep can be put to sleep after being hit by one of these mercy bullets. After a while the effect of the narcotic, which is injected by the powder-propelled, hypodermic-syringe-like bullet, wears off entirely.

The Paris-to-New York Flight

AT 5:54 A.M., on Monday, September 1st, Capt. Dieudonne Coste, the French ace, piloting the reconditioned airplane "Question Mark," started from Paris with Morris Bellonte with New York as their destination. This was the second attempt. Last July they were forced back when north of the Azores, because of head winds which reduced the flying speed. The flight had been planned for three years, and a great amount of care was taken in grooming the plane and in installing a new motor, a 650 h.p. Hispano-Suiza, 50 h.p., more powerful than the old motor with which Capt. Coste made his two world's records. The "Question Mark" has a heating system for the plane's motor, and carries a radio. In event that the fliers would have had to make a forced landing at sea, use would have been made of a rubber lifeboat which Coste (center) and Bellonte (right) are shown testing at Versailles Lake. The lifeboat has a tank of compressed gas.

A Captive Glider

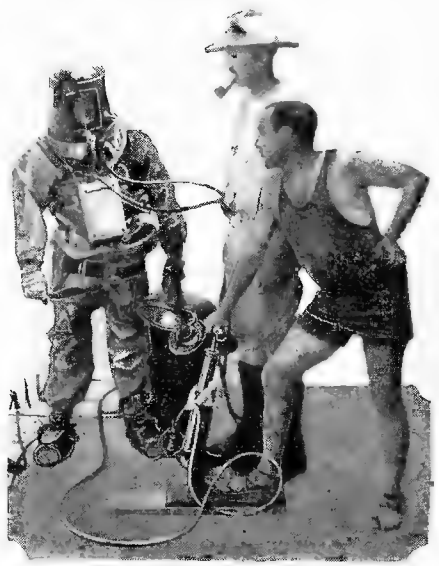


A GLIDER designed to teach the rudiments of glider flying has been mounted on an extension rod fitting in an air cylinder, and attached directly to the chassis of an auto. When the automobile is at rest, the pressure of air in the cylinder is equal to the weight of the plane and its occupants, but when the auto is put into motion, and the controls regulated, the glider rises and falls for a distance of about two feet. A good pilot can maintain good altitude.

Successful Diving Suit of Inner Tubes

OLD automobile inner tubes have been used for a variety of purposes. Rubber bands have been cut from them, the rubber has been cut into strips and used for making bags and rugs, gun cases and pouches, as well as fishing rod holders, have been improvised, and the inner tubes themselves have been used instead of door springs and in place of snubbers.

It remained for Kent Kyle, a professional diver, and Edward A. Nelson, both of Chicago, to develop an entirely new use for old tubes. Cutting the tubes apart and cementing them together, so as to form a garment, and then adding a home-made helmet, the experimenters were able to build a diving suit and actually descended in Lake Michigan to a distance of sixty feet with this equipment. Coming up to the surface again, they pronounced the suit an entire success.



Third Claude Tube Ready

READERS of this publication will remember how we followed the progress made by Dr. Georges Claude, the French scientist, in attempting to produce electric power from the waters of the Gulf Stream, basing the project upon experimental models which demonstrated that the temperature changes between the surface water and water at a great depth could be made to produce inexpensive steam, which in turn operate turbines and these would operate the generators. Two tubes already built and launched were destroyed in the launching process. A third and new one has been built, and every precaution will be taken to prevent possible accident during its launching in the waters of Matanzas Bay, Cuba. So far, a total of $1,200,000 has been invested in the three tubes. Reports of the progress made will be given from time to time in this magazine.

Diving for Treasure in Sunken Ship

IN 1922, following a collision, the steamship "Egypt" was sunk in 400 feet of water with $6,000,000 in gold and silver on board. Divers are now engaged in trying to recover this wealth. In order to do so, they had to break through the deck and finally were able to reach the captain's safe.

The divers are using a torch-shaped observation shell. With this, the diver anchors himself to the bottom and places the shell in any position and at any depth that he might desire. Should the anchor chain break accidentally the diver is able to come up to the surface because the shell will float of its own accord. Anchoring the shell to the bottom prevents it being raised and dropped by the action of waves on the surface of the water, 400 feet above. It is likely that large electro-magnets will be used to lift the safe out of the hull and retrieve treasure and papers that might be found therein. The safe will first probably be blasted away from the wall, to which it is attached, and dynamite will likely have to be used to gain access to the purser's room.

Hitch a Covered Wagon to Your Automobile

A little home on wheels that can be disconnected from your auto or coupled to it and towed in back of your car, is a new development intended for the motor camper and tourist. It is the successor to the English horse-drawn caravan.

HERE is a covered wagon that is rain-proof, dust-proof, insect-proof, animal-proof, and that forms an ideal trailer. It can be coupled to the back of your car, and enables you to carry around with you a little home on wheels. The interior is arranged like a kitchenette apartment. Lowering a floor gives sixteen square feet of kitchen space and ample head room with plenty of space to cook, heat, wash or attend to other camp duties. A gasoline stove is contained for heating the interior. Five large glass windows are provided, and the bedroom is sufficient to accommodate four adults.

German Inventor Develops Wheels That Make Handtrucks of Boxes

TWO, three and four wheel trucks have been used for transporting boxes and freight. The loading of these trucks was always effected with difficulty, particularly when heavy pieces had to be transported. In a newly devised apparatus developed by the German engineer, H. Kiessling, a wheel is attached to an iron angle. When the box is lifted with a crowbar, the wheels are slipped in place and the box itself automatically becomes the truck. Due to the shape of the iron angle the wheels do not fall off even when transportation is over bad pavement. A pair of 40-lb. wheels are capable of carrying nearly three tons of weight.—P. T. A.

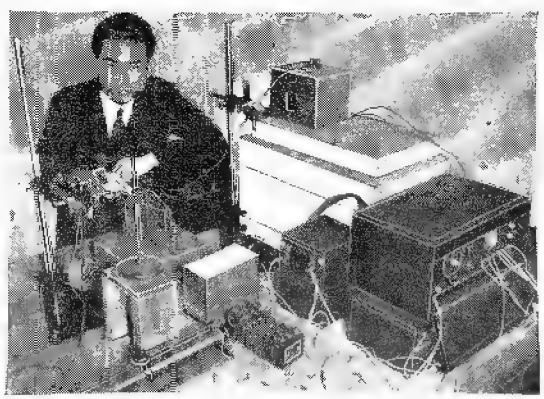
Determining Age of Eggs by Temperature

A SYSTEM of measurements and temperature data by means of which science is able to determine the quality of an egg and its relative age in terms of mathematics is described by Paul Francis Sharp and Charles Kelly Powell of the Department of Dairy Industry and Poultry Husbandry, Cornell University, in a report to the American Chemical Society. Candling and similar tests in popular use are unreliable in forming true estimates of the egg's quality. Temperature is found to be a factor which controls deterioration to an extent not yet commercially recognized. In experiments the quality of an egg dropped to 0.30 in about three days at 37° C., in eight days at 25° C., in twenty three days at 16° C., in sixty-five days at 7° C., and in about one hundred days at 2° C. This indicates clearly the harm that can be done to an egg by subjecting it only a short time to warm temperatures.

Japanese Student Invents Microseismograph

A JAPANESE student, Mr. Namieno, has invented a new superseismograph for detecting and reporting the slightest tremor, however weak it may be. The instrument has been accepted by the University of Tokio and the details will be given for the first time at the International Scientific Congress at Stockholm this fall. Reports would have it that the apparatus is 250 times more sensitive than any existing seismograph.

Seismographs are used for the purpose of recording earth tremors and in that way to enable scientists to determine where an earthquake shock is taking place. Often these tremors occur beneath the surface of the ocean or in places where it would be impossible to obtain any reports. Seismographic stations can, by a series of calculations, determine exactly how far off a quake occurs and when reports are obtained from two or more stations, the position of the earthquake can be definitely fixed. It is expected that with supersensitive instruments much will be learned about this earth that is not presently known.



Seeking Glass Secrets in Death Valley

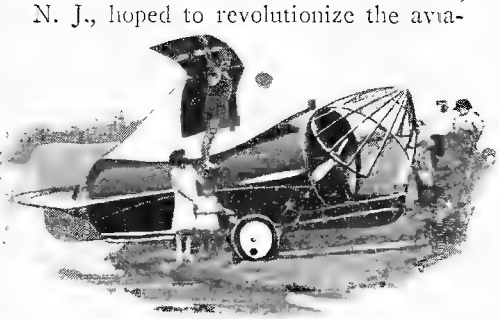
THE lost art of Venetian glass is being sought in Death Valley. Many pieces of glass, bottles, vases are carefully indexed with the formulas composition and exposed to the direct rays of Death Valley's sun at Stove Pipe Wells. This work is being carried on by Professor A. L. Tompkins. Ultraviolet rays of the sun color certain glass compositions a deep purple; others a rich amber. But the process takes from five to twenty years for its completion.

Lard and Salt Pork of Little Value in Preventing Blacktongue in Animals

FOR several years the Public Health Service has been conducting studies relating to nutritional diseases with particular reference to pellagra. A report recently made public indicates the blacktongue preventive potency of lard, salt pork, dried green peas, and canned haddock has been studied. The results show that lard and salt pork are poor sources of the blacktongue preventive. Canned haddock contains the blacktongue preventive factor and, when used in relatively large proportion, the clinical manifestations of blacktongue are prevented. Dried green peas contain the blacktongue preventive but in relatively small amount. Fifty per cent or more of the test animals on the lard, salt pork, and haddock diets showed post mortem evidence of fatty degeneration of the liver.

It Flies, It Swims or Moves on the Ground

THE Comet plane with which Wendel Wobido of East Berlin, N. J., hoped to revolutionize the aviation industry is barrel shaped with a kind of conning tower on top. The plane has no wings but has fins, ailerons and a rudder. An attempt was made to get it off the ground at Florence Lake, N. J., but unfortunately the plane failed to rise. The blame was laid not to the principles of design, but to the motor.



Carbon Dioxide Gas Kills Bacteria

CARBON dioxide gas rids foodstuffs of bacteria, D. H. Killefer of the Dry Ice Corporation of America declares in a progress report on bacterial studies to the American Chemical Society. Use of "dry ice," or solid carbon dioxide, is extending, and is effecting economies in the distribution of the nation's perishable food supply, says Mr. Killeffer. Safer and cheaper transportation will result, he asserts. "Dry ice" is now being employed to safeguard shipments by land and sea, and is being extended to commerce with the tropics. John D. Rockefeller, Mr. Killeffer discloses, relies upon it to preserve butter, eggs and poultry shipped from his Tarrytown estate to his winter home in Florida.

"Carbon dioxide gas kills or prevents the growth of many common bacteria on meat, fish and other flesh foods."

"It appears that carbon dioxide is absorbed by the surface of the flesh, and creates an acid condition which is very unfavorable to bacterial growth. It is perfectly possible to keep meat or fish in an atmosphere charged with carbon dioxide formed by the evaporation of 'dry ice' for several days without spoiling in a perfectly edible condition, even at temperatures far above those maintained in refrigeration practice."

Spoilage by bacteria can be prevented for a period as long as a week.

New Type Aircraft Radio Receiver

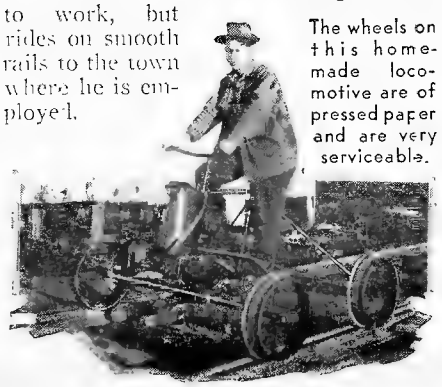
A NEW and improved type of aircraft radio receiver, the model D, is announced by the Stromberg-Carlson Telephone Company at Rochester, N. Y., which will manufacture it following specifications developed by Aircraft Radio Corporation, Boonton, N. J., pioneers in aircraft radio receiving apparatus. Captain R. L. Meredith (U. S. A. retired), former army flight officer, is shown in the photograph. The outstanding new feature is that it is universal as to frequency band and class of service. The frequency range is from 250 to 15,000 kilocycles obtained through the use of a removable coil assembly. The receiver proper measures 15×7½×6½ inches, and weighs but 18 pounds together with tubes.

Paint Your Golf Ball Automatically

AN automatic machine for painting golf balls is a new convenience for the golfer who desires to have his equipment always clean looking. The ball is placed in a slot, a dime in another, and in less than ten minutes the ball comes out looking fresh and white, with a new coat of especially prepared lacquer. A window arrangement at the top of the gargantuan golf ball which encloses the machinery permits the owner of the ball treated to watch its progress.—*R. C. Colling.*

Adapts Bicycle to Railroad Rails

TIRED of walking to work every day and covering a distance of five miles each way, John D. Lemey of Hoquian, Wash., purchased four pressed paper wheels. Then with the aid of a few pipe fittings, he converted his bicycle into a foot-propelled locomotive. So now he no longer walks to work, but rides on smooth rails to the town where he is employed.



The wheels on this home-made locomotive are of pressed paper and are very serviceable.

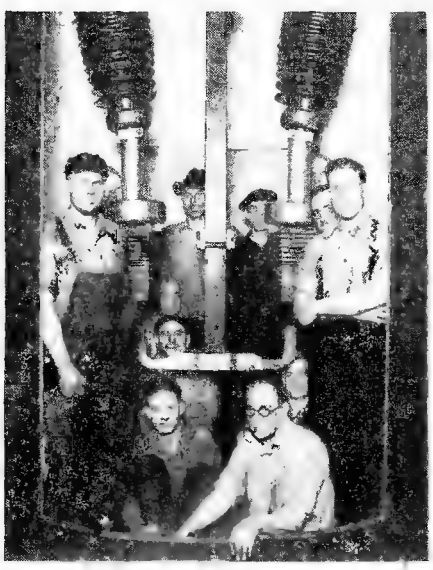
Make Records with Your Radio

A SMALL portable microphone attached to a radio phonograph combination and recently put on the market by the R.C.A.-Victor organization will enable the owner to make his own recordings of any program received over the radio in the home or of the voices of members of his family. The change from one type of instrument to another is accomplished by turning a small switch to either one of four positions. Recordings are made on discs six inches in diameter and can be played quite a number of times without showing appreciable signs of deterioration.

India Bets on Fish Fights

THE fighting proclivity of the Siamese fighting fish form the basis of a sport in India that is comparable to Mexican bull-fights. To place two males into one tank means death to one or both of them. Bets are placed on which of two males in a tank will first die in the battle. Two females will also fight. These fish are generally found in various colors—red and blue, cornflower, blue and green. Often fortunes are won or lost on the outcome of a fight between two fish.

De-ion Grids

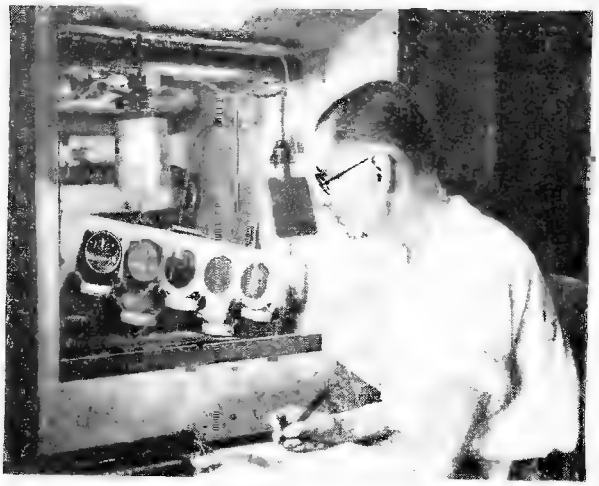


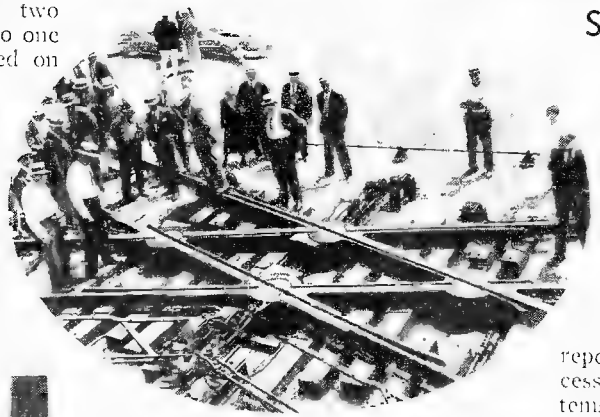
THE ease with which these twelve men rest within the walls of this Westinghouse oil circuit breaker demonstrates the size of this equipment. The "De-ion Grids" fastened to the lower end of the condenser bushing type of terminal break high voltage circuits in a fraction of a second, thus protecting overhead transmission line and station equipment from damage.

The De-ion Grid contains a groove, open at one end, in which the arc is drawn and forced into intimate contact with the entrapped oil by a specially designed magnetic field, making the most efficient use of the oil for arc extinction.

Aiding Aviators by Testing Indicators

THE Bureau of Standards is doing everything possible to aid aviation. The latest step along this line is the testing of turn and bank indicators to show the effect that temperature has upon the accuracy of the readings. This photograph shows R. B. Block of the Aeronautic Instruments Section of the Bureau making such a test with two indicators and five inclinometers. The tests are generally made at two temperatures, the first at a high temperature, and the second at a very low temperature. In this illustration the low temperature test is being taken. A glass enclosed box prevents drafts from disturbing temperature.



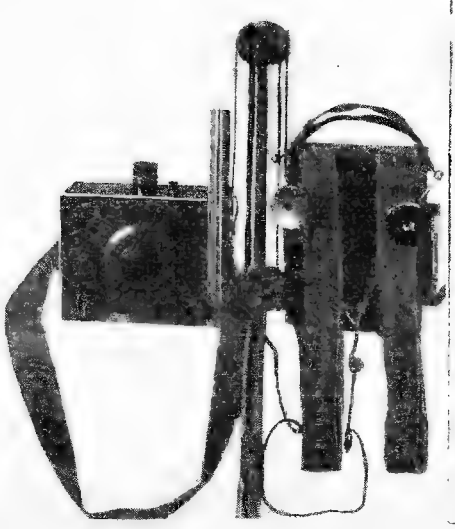


Device to Eliminate Noise and Shock at Track Crossings

DISCS set in the intersection of the rails were installed on a pair of tracks at Southgate, California, for the purpose of eliminating noise and shock when the trains crossed the tracks. The project is the invention of W. H. Whalan, a Los Angeles railroad man. The discs are made to rotate when the train approaches and a groove in each disc lines up with the rail. According to the reports, the device has been highly successful. It is thought that such systems will ultimately be installed on all railroad crossings and thus make for more silent operation and save the cost of frequent track replacements.

Portable Short-Wave Radio Receiver

A SMALL receiver, not much larger than a cigar box, has been designed that can be carried around on the person of its owner. One can receive foreign stations while walking, running or riding. The outfit weighs five and a half pounds, uses one stage of audio amplification and has a 45-volt B-battery. When conditions are good it will give loud speaker reception. A .00015 condenser is used and no vernier dial is needed. The outfit will operate on sixteen meters as well as 180 meters and experiments with it have indicated that it will pick up aircraft ignition noises when the airplane is two miles away. According to its builder, the device will operate excellently when electrical disturbances are not too great. Automobile ignition sounds produce interference. The device was designed by John Melichareck of Houston, Tex., who is seen wearing the receiver and has the battery case and antenna strapped to his back. The photograph immediately below shows the complete outfit.



Measuring the Oiliness of Oil

W. C. Wilharm demonstrating to a visitor a device for measuring the oiliness of oil

BY means of a device consisting of a weighted platform supported by three highly polished steel balls, and resting on an equally highly polished steel plate which is covered by a film of oil, it is possible to measure the oiliness of oil. The angle between the plate and horizontal is increased gradually until the weighted platform supported by the steel balls moves over the distributed film of the lubricant. Naturally, the smaller the angle between the plate and horizontal before the platform begins to slide, the better is the oil for lubrication purposes. The apparatus was developed in the research laboratories of the Westinghouse Electric & Manufacturing Company.

Fastest Commercial Plane to Show More Speed

THE fastest commercial airplane in the world is intended to show still more speed when it is entered in the Chicago air races. The craft is the low-wing monoplane Texaco 13, and although he recently established two new transcontinental records in it, Captain Frank M. Hawks arrived at the National Air Races with the ship displaying new racing wings, a smaller and faster propeller, landing gear without brakes but with "pants" of finer streamline. The brakes and navigation lights on the wing tips and tail were removed and other changes, which Captain Hawks has declined to explain, were made to decrease wind resistance, and although he gave no estimate of his speed tests in the altered craft a pace of 300 miles an hour or greater is expected of it.

The Chicago races, and especially the Thompson Trophy free-for-all event on Labor Day in which Captain Hawks will oppose the best speed pilots of the Army and Navy and commercial aviation, will prove the full potentialities of the Texaco 13, a Travel Air special Mystery S, driven by a Wright Whirlwind motor of 400 horsepower. At the races Captain Hawks is scheduled for demonstration flights in his speed plane and in the Texaco Eaglet, the glider in which he was towed from San Diego to New York last spring. What he will do in the Thompson Trophy competition is exciting the greatest interest.

Some idea of the Hawks craft's speed may be had by consideration of its transcontinental flights. It averaged more than 200 miles an hour.

Solarium That Turns With the Sun

A UNIQUE solarium has recently been erected at Aix-les-Bains in Savoy, France, for the application of heliotherapy for sick people. It contains several glass-enclosed rooms partitioned off from each other. The patients sleep in these rooms, and whenever they wish they can go up on the roof for a sun bath. The roof is fenced in. The whole house is so constructed that it turns on a giant axis and is turned with the sun, so that the patients can get the full benefit of the direct rays of light.

Portrait Stamps to Prevent Fraud

IN an effort to prevent fraudulent forgery of signatures, Mr. Thomas Smith, of Worcestershire, England, has developed a unique system consisting of an adhesive stamp bearing the portrait of the signatory. Whenever a check is stamped, one of the gummed stamps is affixed, and the signature signed across the face of the portrait. Under special arrangement with the bank, only those checks bearing the portrait are accepted for payment.

Phonograph Records That Can Be Bent or Hammered

DURIUM is the name of a new chemical substance that was recently discovered by Dr. Hal T. Beans, Professor of Chemistry at Columbia. This product in its first commercial application, has been found to be ideal for phonograph records in that it is flexible, shatter-proof and practically unbreakable. It is contemplated that disk records made of this substance will be sold from the newsstands, and a new dance hit of the week will be available throughout the country every Friday or Saturday.

Vincent Lopez, popular New York orchestra leader, is shown applying a flame to a phonograph record made of Durium. The record does not burn, and can be treated in this fashion with perfect safety

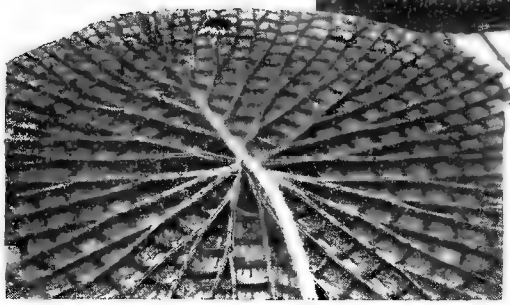
Left: Dr. Hal T. Beans, demonstrating the shatter-proof qualities and the flexibility of a record made of Durium, a new chemical substance which he invented

Would You Believe It?

Pulling a Locomotive with a Bell Cord

YOU would never believe that three men pulling on an ordinary bell cord would be able to move a monster locomotive weighing 350 tons, or 700 000 pounds. Yet in a demonstration to show that this could be done, one of the steel giants of the road was pulled for a distance of 50 feet, and there was no one at the throttle. The tow line consisted of an ordinary bell cord. The next time you observe one of the giant locomotives as it thunders along the rails, just remember that you yourself could almost push it along without assistance if the brakes were released. Let this thought convey the impression of the remarkable engineering involved in eliminating as much friction as possible.

We will pay $5.00 for each photograph accepted and published on this page. Address, "Would You Believe It?" Editor, c/o SCIENCE & INVENTION, 381 Fourth Avenue, New York, N. Y.



A Plaything of the Wind

WE see here an unusual tree formation characterized as a wind-harp, but this is different from the wind harp known to every student of physics as the Aeolian harp. Trees such as this one may be found on the top of high mountains; they are distorted into this shape by the winds. This one is situated on the Continental Divide in the Rocky Mountains.

Where Drains Run on the Outside of Houses

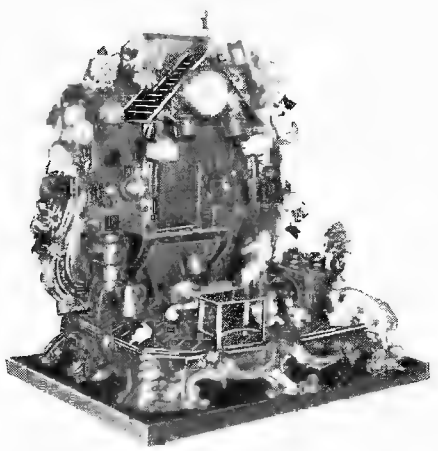
ONE of the most picturesque countries, full of enchantment, is the island of Corsica, now belonging to Italy and the birthplace of Napoleon. While little known to the average man, it is frequented by poets and artists. Houses in Corsica have drainage systems, but instead of having the system within the structure of the house itself, the pipes running down inside the walls, a view of a Corsican city backyard will show the ancient drainage systems going down outside the outer walls.

Lily Pads that Can Support a Child

AT the Berlin Botanical Gardens, the lily, Victoria Regia, was photographed while in bloom. This flower blooms only one day every year. Of South American origin, it possesses leaves that are so strong they can easily support the weight of a four-year-old child. The reason for this strength becomes more apparent when one looks at the undersurface of a leaf shown in a closeup photograph. The peculiar ripped structure is readily discernible.

The Victoria regia was named in honor of Queen Victoria, of England. It was supposed to have been first observed by Hanke in 1801, but was first described in 1832, by Poeppig who found it on the Amazon river in South America. The leaves attain a diameter of five to six feet. The margin turns up about two inches so that it forms a shallow vessel. The flowers are over a foot in diameter. It has been cultivated in hot houses in botanical gardens here and in Europe.

Famous Kitchen Clock



FOR the first time in history, 150 years after her death, the closely guarded quarters of the Empress Maria Theresa, of Austria in Castle Schoenbrunn, were open to the public. Much of the furniture has played a part in European history of the eighteenth century, and is considered to be of exceptional artistic value and beauty.

One of the points of interest is the famous kitchen clock, which was first presented by Empress Marie Antoinette of France, to Countess Hoyos, who in turn presented it to Maria Theresa. Kitchen utensils in miniature and porcelain flowers and figures decorate this ancient timepiece.

A Visual Attack

A pair of medium selenium-red discs may help the airman to find a port in a fog.

Much Has Been Said About the Fog Been Said of Methods of Combating the Average Airplane Pilot or Motorist. Data and Means Which Anyone

By Lieutenant

THE practical application of the visual filter idea is simple enough. For the ship lookout, a pair of red spectacles and possibly a pair of yellow ones; for the aviator, perhaps extra red and yellow glass discs that will slip inside his goggles, or a red filter on part of the windshield. The proper colors are widely available to experimenters. High transmission yellow is closely matched by amber theatre gelatin; and Kodaloid (the Eastman printing mask material) duplicates medium selenium-red. This field of research is at least interesting, and may possibly yield some results of definite value.

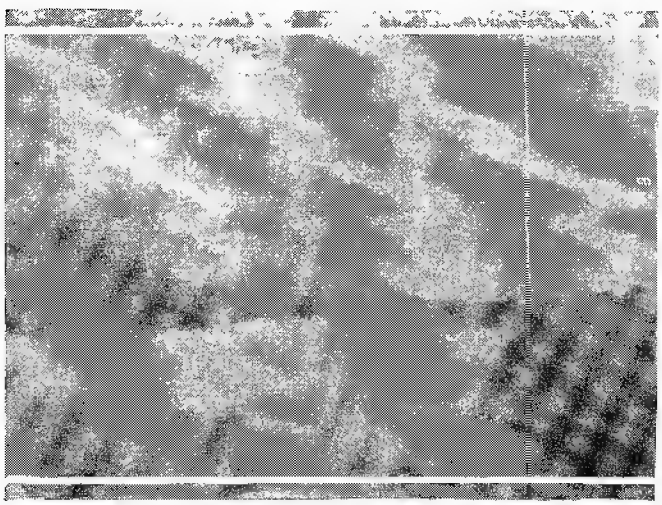
Briefly summarized, the principles of visual fog filters as our experiments have revealed them are these: No filter is a panacea; advantages are slight at best. Mixed filters (blue, green, purple, etc.) are of no value; only "pure" filters (cutting off all wavelengths shorter and all frequencies higher than a certain point in the spectrum) are worth trying. For any given conditions, the deepest filter possible (cutting off at the lowest frequency) should be used. The usable depth of filter will depend on the intensity of light available. Sunlight permits cutting off all colors except red; in ordinary daylight we must pass red and yellow; at night we need red, yellow and green. For beacons and searchlights a yellow filter is helpful when the observer is behind the light or looks in any direction except straight into it; when the observer looks directly into the light no filter should be used. From these principles let us hope that there will develop some practical applications conducive to greater safety of transport on land, on the water and in the air.

AIR transport and water transport bow to a common enemy—fog. A surface vessel can slow down or anchor when the fog blanket descends; an airplane can often return to a clear landing field. But the ship may be rammed in the murk, and a plane forced to come down blind is courting destruction.

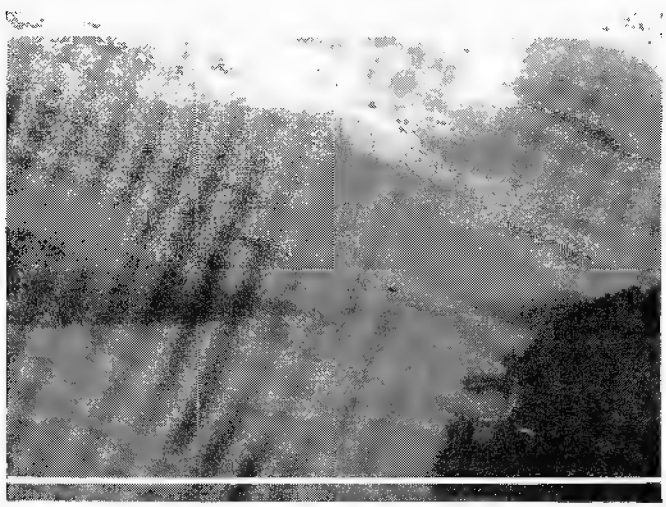
Fog danger is much more pressing in the air, where minimum speeds approach a hundred miles an hour. For this reason, perhaps, aviation is more active than shipping in grappling with fog problems. Aside from great improvements in standard airplane instruments, the chief avenues of attack have been radio (dark light) and visible light. The radio beacon, the radio altimeter and other navigation aids have in the hands of experts shown very promising results; but most pilots are from Missouri in emergencies—they naturally want to *see* a landing field before they try to land on it. On all airways far more power is being put into visible light than into radio signals. In the northeastern United States, in fact, one can hardly get beyond sight of a revolving searchlight on a clear night.

It has long been known that red and yellow light penetrate fog better than blue light; witness the "secret" blue convoy lights in the wartime submarine zone, experiments with yellow automobile headlights, red and yellow filters for military and naval sighting telescopes and range finders, and the pinkish neon aviation beacons of recent years.

Before going very far into a discussion of seeing through fog, one must inquire somewhat into the nature of fog and into the nature of light. The minutest form in which water appears in the lower atmosphere is haze, though in this phenomenon dust particles and air mixing play their parts as well. At any rate, the haze particles are very small—probably on the order of a millionth of a centimeter in diameter. Particle size, as we shall see, is an important factor in light penetration. Haze usually spreads quite uniformly over the



This shot was taken down the Hudson from West Point through a haze, with a camera equipped with only the standard clear lens.



A ruby red filter cleared the landscape considerably, as this photograph shows. Visibility is extended to about four miles.

on the Fog Problem

Problem in the Past Few Years, but Little Has It Which Might Be Possible of Application by . . . In This Article Lieutenant Wenstrom Offers Encountering the Fog Problem Should Find Useful

William H. Wenstrom

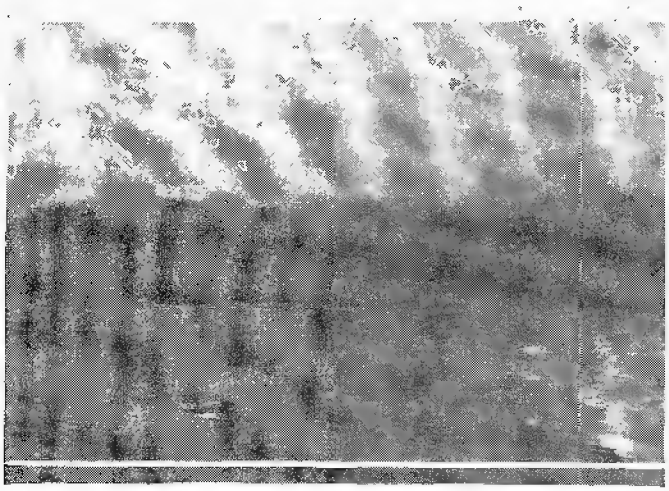
Lieutenant William Holmes Wenstrom was born in Sweden, but came to the United States at the age of three. He graduated from West Point and was commissioned in the regular army in 1918. He is now instructor in English at the U. S. Military Academy; his interests cover radio, electricity, writing, physics and other fields.

landscape, and extends upward with little change from a few hundred to a few thousand feet. Fog, on the other hand, may be detached clouds in contact with the ground, generally filling hollows and valleys; or it may be a continuous layer over the whole landscape and a section of ocean. The murk may be bad on the ground, and worse as one climbs several hundred feet. On the other hand, one may be in "pea soup" at the ground or water level while the sun shines a hundred feet overhead—sometimes the masts of a ship project above a fog which enshrouds the ship itself. Fog looks much more dense than haze because its water droplets are larger—on the order of a thousandth of a centimeter in diameter. The upper end of the moisture scale is, of course, rain or snow, of which the particles are perhaps a tenth of a centimeter or more in thickness.

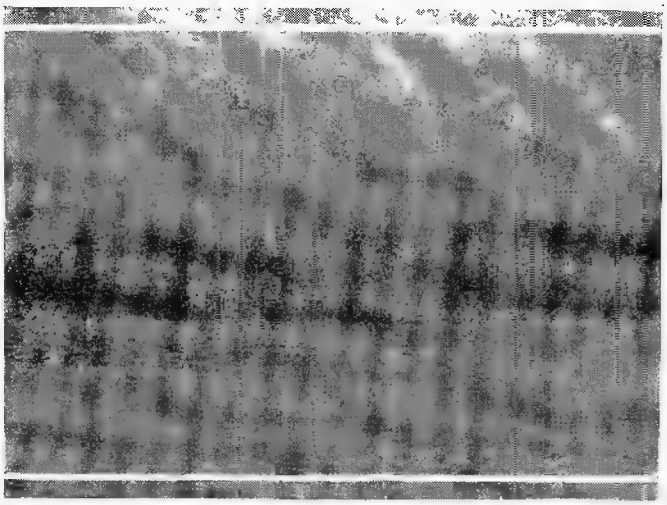
Having in mind a picture of the medium we expect light to penetrate, let us briefly review some of the facts concerning light itself. Light is in general an electromagnetic disturbance similar to radio waves, but of much shorter wavelength. Whereas radio waves are measured in meters, light waves are measured in Ångströms, or hundred millionths of a centimeter. When white light is spread out into its constituent colors, the result is called a spectrum; the rainbow is a familiar example. As the diagram shows, the colors of the visible spectrum begin with red at about 7000 Ångströms and progress through yellow, green and blue to end with violet at about 4000 Ångströms. Color sensitivity and general light sensitivity of the human eye is thought to be due to three types of nerve-endings in the retina; one type responds chiefly to red, a second favors green, and a third favors blue. The peak of total light sensitivity falls in the green at about 5350 Ångströms.

Various light sources emit spectra of different types. For example, an incandescent solid such as a tungsten filament emits a continuous spectrum extending smoothly through all the colors it includes; a rarefied gas as in a neon bulb emits a series of sharply defined bright lines with complete darkness between them.

In brief form, accurate enough for present purposes, the law which governs the scattering or penetration of light in haze or fog may be expressed thus: When the particles of the medium are small in relation to the wavelength of the light, clear image penetration (or freedom from scattering) varies as the fourth power of the wavelength. This means that in pure air red is going to come through much better than blue, as shown by the blue sky (blue light scattered) and the red sunset (red light transmitted). In haze, where several of the particles would have to be placed end-to-end to make a wavelength, red still retains a surprising lead over blue. In fog, where the particles are more than a wavelength in diameter, this lead is cut down but not altogether obliterated, as our experiments show. In heavy rain or snow red has no theoretical advantage at all. Granath and Hulburt have found that in medium fogs infra-red waves up to about twenty or thirty thousand Ångströms show little advantage over visible red—that the increase of transmission with wavelength is mostly confined to the visible spectrum. What the infra-red waves above 30,000 Ångströms may do is quite in the future—if anyone can invent (*Continued on page* 650)



Through a medium fog a standard clear lens gives an extremely vague view of the east bank of the Hudson.



The use of a medium selenium-red filter emphasizes the contrast between land, water, and sky.

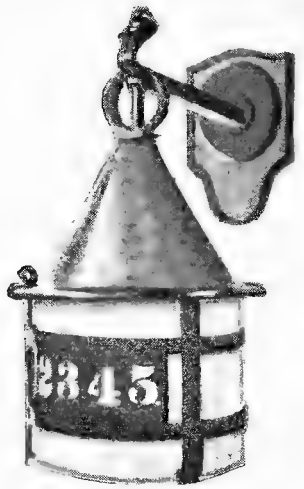
Why Not Light Up Those Dark Corners?

By Mary Anne Sheppard

Home Lighting Specialist, Westinghouse Lamp Company

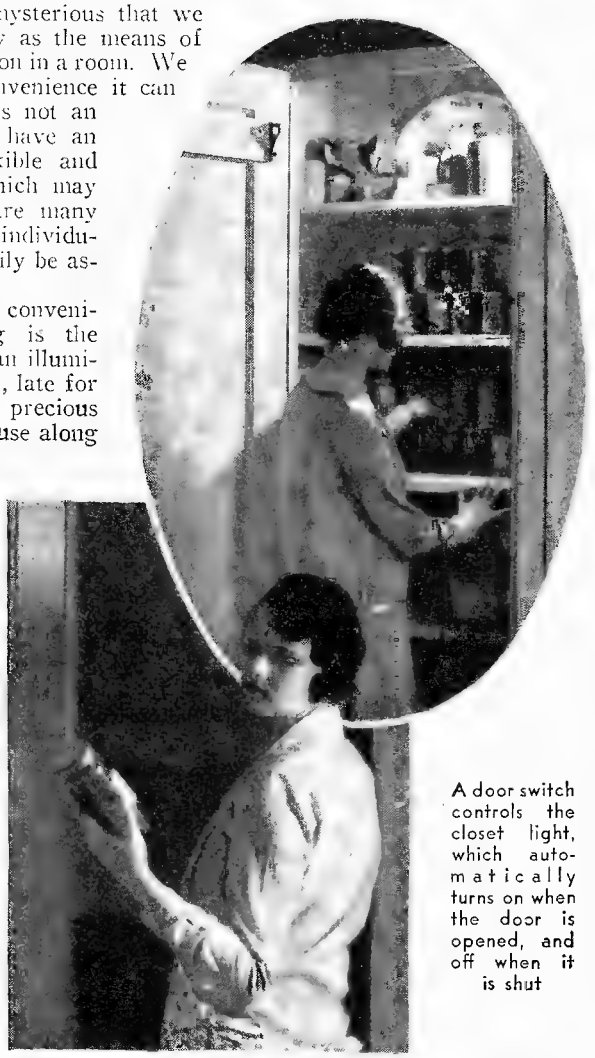
ELECTRICITY is still so mysterious that we are apt to think of it only as the means of supplying general illumination in a room. We forget how much beauty and convenience it can add to the house. One's home is not an empty place, but has or should have an atmosphere, and light is a flexible and mobile medium of decoration which may create varying moods. There are many lighting devices which will give individuality to your home, which can easily be assembled in any home workshop.

One of the newest and most convenient additions to home lighting is the porch light which also serves as an illuminated house number. Many of us, late for an engagement, have spent precious minutes looking for our host's house along a dark street. A lighted house number shows up at a glance and an entrance is made more distinctive when this is a part of an attractive lighting unit. It may be a bracket type fixture or a lantern type such as the one illustrated. There are many styles, suited to all types of architecture, and they are quite inexpensive.



This lantern-type porch light also serves as an illuminated house number

Inside the house there are countless unusual applications of light, which give charm to the home as well as add to the convenience of living. If the whole family occupies a sleeping porch and there are very young children who retire early, one may wish to have a light there, which provides a soft illumination without disturbing the sleepers. A lamp in a porcelain socket, or a miniature reading lamp with a clamp device, fastened to the under side of the bed, will throw a glow of light over the floor, so that a late comer may see plainly without the light shining directly into the other's eyes. This may be particularly useful in a nursery or a sick room.



A door switch controls the closet light, which automatically turns on when the door is opened, and off when it is shut

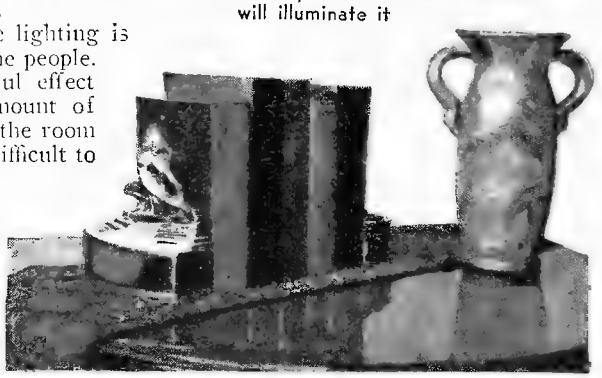
A reading lamp with a clamp device fastened under the bed to light the playroom floor

A dining room with cove lighting is the dream of many home people. Aside from its beautiful effect it gives a sufficient amount of soft light to illuminate the room properly. It is not as difficult to install nor as expensive as is commonly supposed. If your dining room has a plate rail it can be covered with asbestos, and a string of Christmas tree sockets fastened along its upper surface. Twenty-five watt tubular lamps or the small ten-watt round lamps may be used. These smaller lamps should be placed only six or eight inches apart so that they do not produce a spotty appearance along the wall. If the lamps show, a moulding of wood or painted tin is used to conceal them and reflect the light against the wall and ceiling. Where there is no plate rail, a strip of molding, slightly larger and with lamps attached to it, may be fastened along the wall two feet or so above eye level.

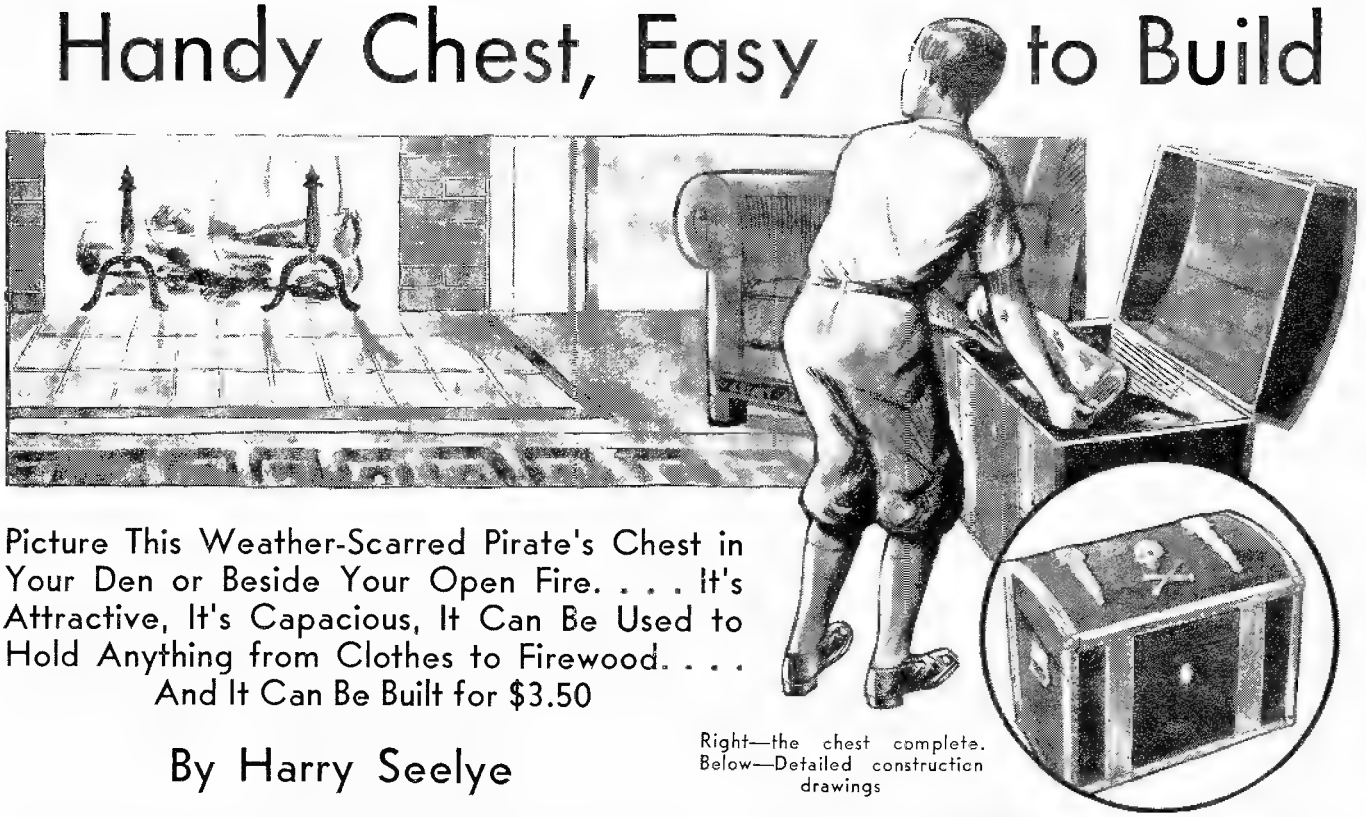
Sometimes one of these ten-watt lamps is used to emphasize a note of decoration in the living room or library. The accompanying illustration shows a mantlepiece with a clock on it and a picture hanging above this. The tiny lamp, in a porcelain socket is concealed behind the clock and connected to a convenience outlet. This throws its light upon the picture, making it the center of attraction in the room. There are countless places where a bit of light may be used to floodlight or spotlight some such object, picking it out as the focusing point of the decorations. Often one is used inside a lovely transparent vase to bring it to life at night, or behind a graceful ornament to produce a silhouette.

The illuminated bookends shown in an accompanying illustration are an unusual way of providing an individual note in a room, and can be easily made. First, the bookends proper were purchased, and then copper frames of the desired size and shape were made as a base for each of them. On the top of (*Continued on page* 657)

A ten-watt bulb in the base of your bookend will illuminate it



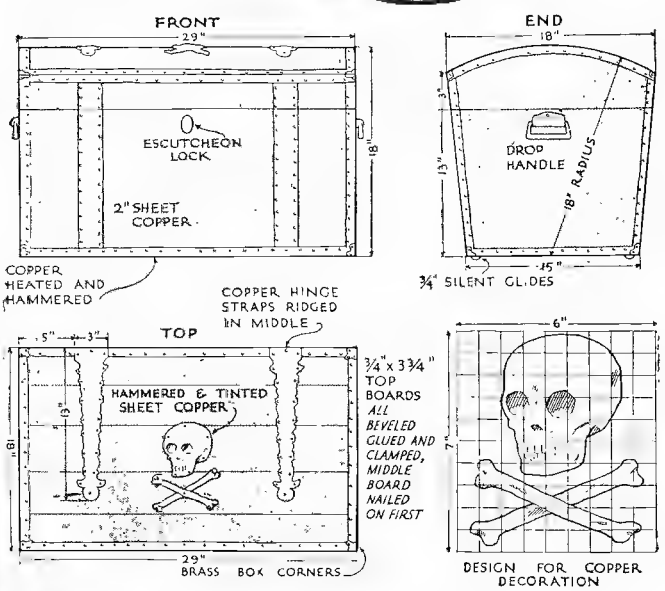
Handy Chest, Easy to Build



Picture This Weather-Scarred Pirate's Chest in Your Den or Beside Your Open Fire. . . . It's Attractive, It's Capacious, It Can Be Used to Hold Anything from Clothes to Firewood. . . . And It Can Be Built for $3.50

By Harry Seelye

Right—the chest complete. Below—Detailed construction drawings



An attractive pirate's chest wood box, designed by A. O. Horning, head of the wood-working department of the John Marshall Junior High School, Pasadena, Calif., is so simply made that anyone with some small experience and the proper tools can produce a first class job. When completed and properly finished it is a distinctive asset to your fireside, holding enough fuel for several evenings, and preventing litter from marring the appearance of the floor or hearth. The hinged lid conceals the contents. And scores of them have been made by Mr. Horning's students at an average cost of $3.50 each!

Mr. Horning recommends California redwood, or cedar, as a very satisfactory material because of its property of lightness combined with strength. Either wood is easily worked.

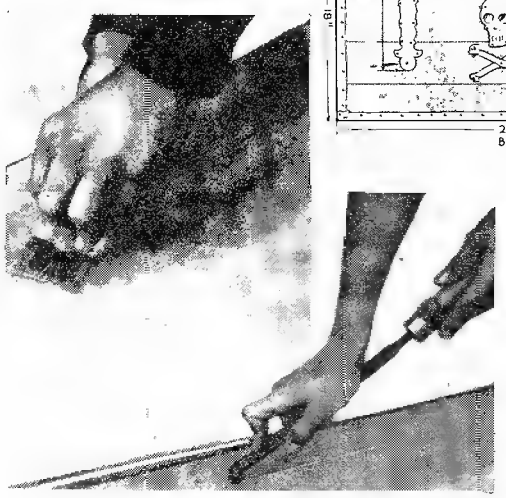
First make the ends and sides, built up of fairly wide boards glued together before cutting to size. Side pieces are secured to ends with No. 10 flat-head wood screws 2" long. The bottom is a single piece of ⅜" plywood, with ¾" "silent glides" at each corner.

In building the top, nail down the center board first. All top boards are ¾" by 3¾", and beveled on the edges to allow for the curve of the top. Glue edges of the boards and clamp them together while nailing down. Note that the lid is sawed *after* the box is made up. This insures flush sides all around.

Three-inch butts are used at the back side, and an escutcheon lock is mortised in to the front, with a hinged link to prevent the top from opening back too far.

Much care should be given to the finish, which is an attractive weathered driftwood effect. Having scraped the glue from the joints and planed the top fairly smooth, dampen the surface and run a stiff wire brush along the grain, pressing down hard. This gives the appearance of wood long exposed to the elements.

A light gray stain is applied next, followed with touches of brown and green to give a somewhat mottled effect. Powdered water stain is very satisfactory for this purpose. A light coat of varnish can be applied if this finish appeals to you. The inside is done in natural-wood varnish.



Scraping the glue from the joints (lower illustration), planing the top fairly smooth and running a stiff wire brush along the grain (upper illustration) will produce a weathered driftwood effect.

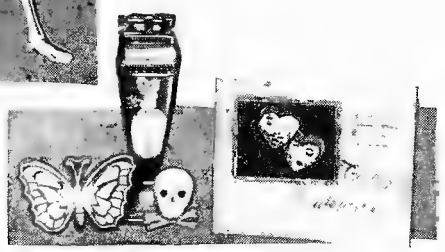
For the straps, corner bindings, false hinges, and skull and cross bones use light gauge sheet copper, which is easily hammered. First put on the broad straps with gimp nails or escutcheon pins. Heating the copper before putting it on discolors it and gives the effect of age, and battering lightly with a hammer or blunt punch further adds to this impression. Corner bindings are nailed on in a similar manner. Note that the hinges are cut in somewhat irregular shape as though corroded by the action of salt water, and along the center for about half their length they should be ridged. This is accomplished simply (*Continued on page* 647)

LUMINOUS PAINT and Its Preparation

By George D. Donaldson

Those Who Like to Experiment with Chemicals Will Find That the Preparation of Luminous Paints in Colors Is Interesting, Educational, and Fascinating

A jointed pasteboard skeleton painted with luminous paints can be made to cut fantastic figures in a darkened room.



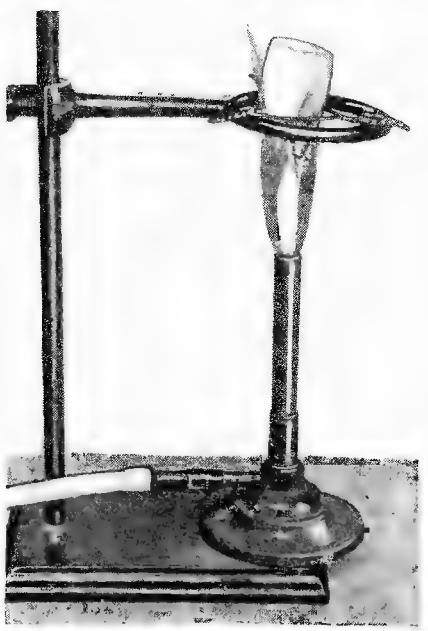
A luminous butterfly, cigar lighter and valentine.

TOPS that shine in the dark when they spin, luminous valentine and greeting cards, cigarette lighters that shine at dusk and weird dancing skeletons can all be made by one who likes to experiment with chemical mixtures.

The basis of luminous paint is a sulphide of zinc, calcium, strontium or barium, with certain exciters such as compounds of bismuth, uranium, manganese, thallium, etc. The simplest phosphorescent substance is made by heating calcium oxide (pure lime) with one-third its weight of sulphur and then adding a drop of a five percent solution of bismuth nitrate solution to every fifteen grams of the mix. The whole is then mixed, dried and heated to redness in a crucible over a Bunsen burner for half an hour. One may use barium carbonate with sulphur, also strontium carbonate with sulphur, and adding a drop of five percent bismuth nitrate solution, or manganese sulphate solution, with or without the same amount of thorium nitrate solution. The resulting products will have different colored phosphorescences, when exposed to a strong light and then viewed in the dark.

If the experimenter makes many mixes and calcinations, then new clean crucibles should be used on each "batch." Clay bubble pipes make good crucibles, and their cost is a tenth that of the chemical porcelain crucibles. Working with clean crucibles, contaminations from previous preparations are avoided.

Hold a leaf against a sheet of paper prepared with luminous paint, then expose to the light; in the dark the outline of the leaf will appear as a luminous area.



The bowl of an old clay pipe makes an excellent crucible and a different bowl is used for each chemical mixture. Clay bubble pipes are cheap; they are destroyed or put aside after any color has been prepared, thus preventing contamination from previous mixtures.

Another method for making a luminous product is to pass hydrogen sulphide gas into zinc sulphate or zinc chloride solution, and also adding a solution of cadmium chloride during the passage of the gas. The precipitate of zinc sulphide and cadmium sulphide is filtered off, washed, and calcined in a crucible provided with a cover which will shut out practically all the air. Clay works well with a bubble pipe bowl.

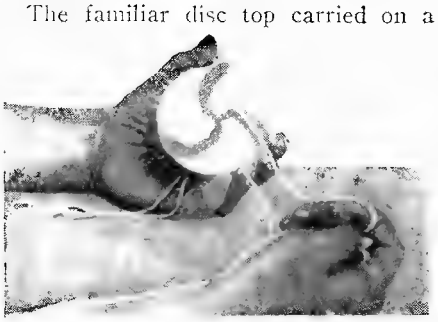
Another mix is 40 grams barium oxide, 9 grams of sulphur, 0.7 grams of lithium phosphate and 3cc of a solution of 0.4 grams of copper nitrate dissolved in 100cc of denatured alcohol. The whole is calcined for three-quarters of an hour. It glows red.

One may buy a very good grade of luminous paint from various manufacturers. Collodion, gum arabic, and very thin spar varnish can be used singly as a vehicle for the phosphorescent substances which you may make.

A dancing, jointed, stiff paper skeleton is sold at many novelty and carnival goods stores. Such a skeleton about 15″ high painted with luminous paint will cause much amusement when operated in an absolutely dark room. Strings tied to the limbs will enable one to make it dance in a very realistic manner.

A card coated with luminous paint can be caused to give a very pretty effect if a leaf, some lace, a paper cut-out or other figure is held over it and the coated side held to a strong light. When the card is viewed in a darkened room, an image of the object now removed, can be clearly seen. Photo negatives produce weird results, and it is possible with a good grade of paint coated very evenly upon the card to recognize the characters of the negative glowing in the dark!

The familiar disc top carried on a looped string and spun with the hands can be made to give a fire-effect in the dark if it is painted or streaked with a



A disc of cardboard painted as indicated produces a top that shines in the dark while it spins.

(*Continued on page* 649)

A Rope Hog-Oiler

HERE is a simple oiler that operates with old crankcase oil from the bus or the tractor, or the special kind if you wish. . . . A six-by-six timber is set two feet into the ground, and a two-inch auger hole is bored down through it, as far as possible. Then the timber is wrapped with old rope about 1½ inches thick, and small gimlet holes are bored between the turns into the center well. Pour oil into the well, and it seeps out, soaking the rope. The hogs do the rest without any further trouble to you.

Hanging a Lean-to Door

THE lean-to kind of barn or shed needs a full-width door like any other building that ought to be weather-tight. . . . The door pictured above does the job in a neat and convenient way. There's really two doors, one hinged to the other, the main one being level on the top and hung from a regulation door hanger. The other door follows the roof angle and is hinged to the righthand edge of the sliding section. The rig is light enough so that the track and doors work in a very satisfactory manner.

Down on the Farm

By Bill Richards

Bill Richards Has a Sharp Eye for Handy and Helpful Ideas—Look at These

Winter-Proof Your Porch

WHEN the cold winds begin to come down from the north, the back porch becomes deserted again and starts to go to waste until spring. But an hour's work will winterproof that porch and make it nearly as tight as an inside room. Stretch ordinary muslin over the screened part, and the screened door, and fasten it with tacks. Then dissolve about as much paraffine in high-test benzine as it will take, and paint the cloth with it. Use a wide brush. Make long, fast strokes. The coating left is weather-proof.

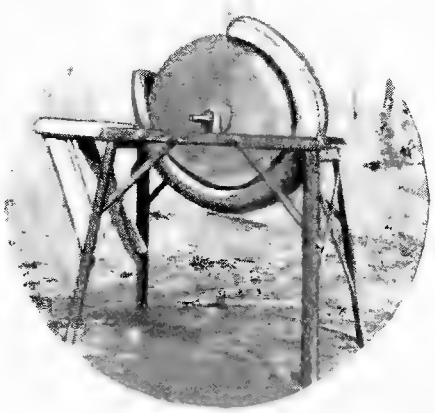
Rock Truck and Granary

THE rock truck shown below clears the ground by only six inches, making it easy to load. An old manure spreader furnished the body and frame. Front wheels from the same machine were put on behind, and smaller ones in front. . . . You can haul almost anything in it. . . . The granary shown above holds 25 bushels. It's mounted on two iron truck wheels and the front axle and wheels of an old car. Bed pieces are timbers, and the bin is matched lumber, nailed to studding placed outside. The roof is hinged and covered with tarpaper. The outfit is easily moved from pen to pen.

Nearly Every Farmer Can Find Use for One or More of These Wrinkles—Isn't It So?

Water for the Grindstone

THERE is a simple method of keeping the edging surface of a grindstone wet at all times while something is being sharpened. The only things necessary to make the rig are an old tire casing and enough wire to fasten it firmly. Part of the casing is cut away to leave plenty of room for contact between the stone and the axe, or whatever you are sharpening, and the rest of it is wired up so that it surrounds the stone by something more than half. You pour in a quart of water, and the stone turns without splashing.



The finished bookcase looks well in the living-room.

Make Your Own Modernistic Bookshelves

By H. L. Weatherby

Director of Manual Training, Montgomery County Schools, Montgomery, Alabama

Most Bookshelves Are Rather Dull and Uninspiring to Look at, But Here's a Modern and Attractive Design for a Useful Bookcase Which the Veriest Novice at Wood Working Can Make for Himself, Out of Any Lumber Which He Has Lying Around

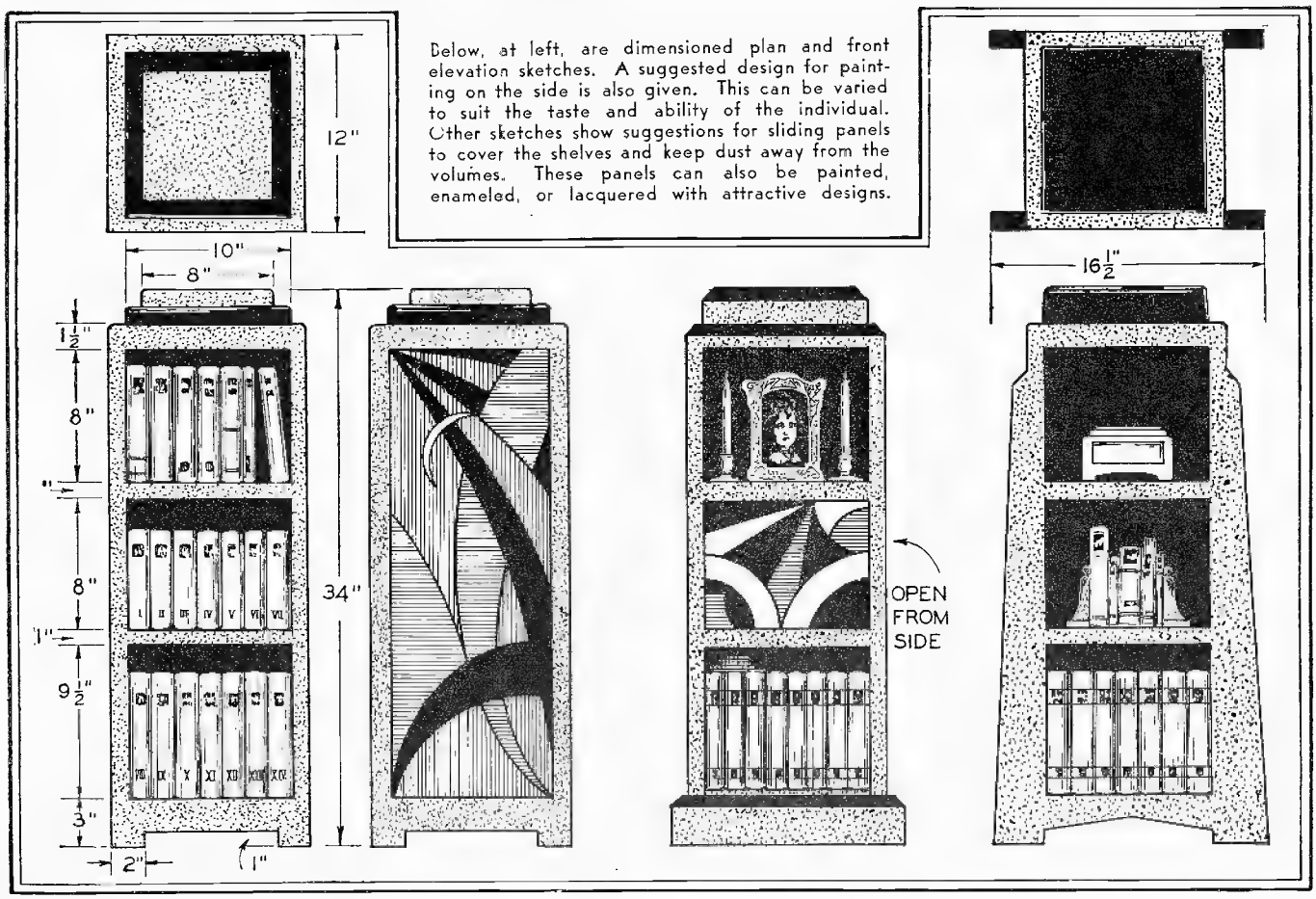
THE bookshelves shown in the drawings are not bookshelves in the ordinary sense of the word, but are more in the nature of a living room article of furniture with convenient receptacles for the accommodation of books, magazines, vases for flowers, knick-knacks, and a reading lamp, or bowl on top. By filling the shelves with books, a fair-sized library can be accommodated. If desired for bedroom use, the bookcase will be found to be a very useful article as a bedside stand. It can also be used as a place to store one's extra shoes. By placing the usual smoking stand accessories on top of any one of these designs the bookcase will become an excellent article of furniture to place in a man's room or study, to be used as a combination bookcase and smoking stand.

The decorations are modernistic and in keeping with the design. The construction is very simple and no trouble should be experienced in the building of it by even a novice at wood working.

Grooves are recommended for fitting the shelves into the sides or uprights. These, however, may be dispensed with, and the shelves fastened in place with dowels or screws. These methods are all illustrated.

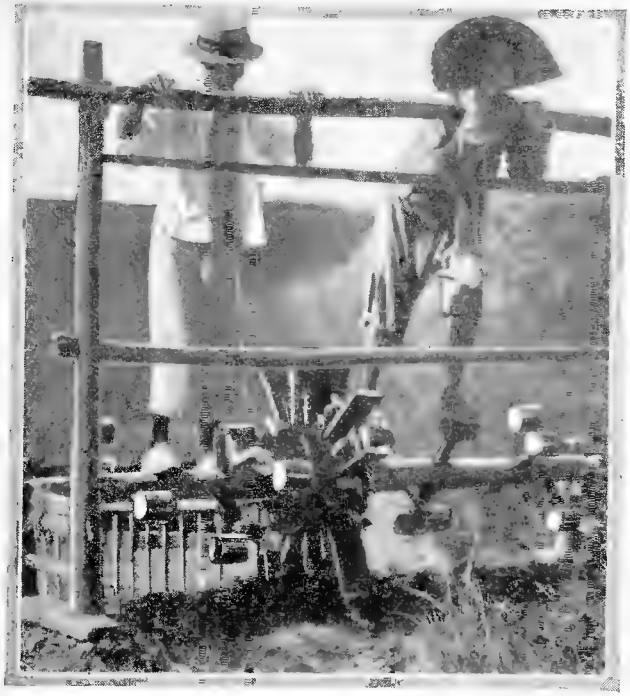
The finish will probably prove to be the most troublesome feature. There are several different ways of going about this. Either quick drying enamel or lacquer in about three colors that harmonize will probably be the choice of materials. The softer tints of almost any of the colors will harmonize, and one expects a piece of this sort to be gay and bright.

In finishing, all holes should be carefully filled with putty, and then if an open grained wood has been used, the whole surface should be given a primer coat, after which this should be followed by (*Continued on page 669*)



Below, at left, are dimensioned plan and front elevation sketches. A suggested design for painting on the side is also given. This can be varied to suit the taste and ability of the individual. Other sketches show suggestions for sliding panels to cover the shelves and keep dust away from the volumes. These panels can also be painted, enameled, or lacquered with attractive designs.

FOOTWORK!



In many countries of the world workmen perform tasks with their feet. In China, feet turn paddle wheels that mix paste for pottery or pump water for irrigation.

These mechanics in Algeria use their fingers and toes on a primitive lathe for making chair legs, rungs, and other turned wood. The tool is a sharp knife.

In Syria we find foot power used for crushing grapes in the wine-making process. The grapes are dumped into vats, and the workers crush the fruit by trampling it. The grape juice flows through a funnel-like pipe beneath the box into earthen containers.

A three-man primitive pump for irrigating rice fields in South India. Two of the men walk back and forth on the suspended pole, balancing themselves with sticks.

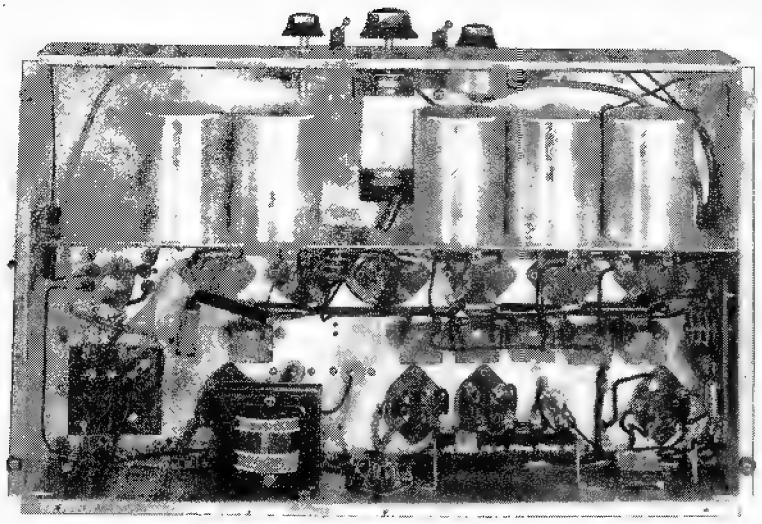
In parts of China where tea raising is the chief trade, tea leaves are rolled with the feet. Notice that the men rest on a support of three sticks, to prevent them from getting tired too quickly.

A few miles from the city of Algiers, men wash their clothes in a little stream on the outskirts of Bou Saada. They use their feet instead of their hands for manipulating the clothes on the rocks in the stream.

Ewing Galloway

A Moroccan flower-basket maker weaving a straw basket with both hands and toes.

CHECKING UP ON



Ordinarily the Broadcast Listener and the Radio Experimenter, too, Are Not Afforded the Opportunity to Know What Takes Place in a Radio Manufacturing Plant from the Time a Receiver Is Designed Until It Has Its Final Production Test. He Must Either Take It or Leave It. This Article Gives an Insight Into the Extreme Measures Taken to Safeguard and Insure Against the Use of Inferior or Defective Parts in Radio Receivers by Rigid Repeated Tests and Final Assembly Tests

The engineering and test procedure principles outlined in the test are reflected in the design of the superheterodyne illustrated above

IT is recognized by set manufacturers and parts manufacturers alike that the tolerances to be maintained on the component parts of high grade radio sets are becoming more and more narrow. The careful design of the circuits now most commonly used presupposes an accuracy unheard of a few short years ago. Radio-frequency transformers must now be held within close limits as to effective inductance, coefficient of coupling, etc.; fixed condensers must be of capacity specified by the circuit designer, and not just "about so and so." In particular is this true in dealing with the couplings providing the so-called band-pass effect, where extremely small variations in the percentage of the couplings will upset the designer's intentions as to band width.

The superheterodyne is one example of a combination of various types of couplings, both r.f. and i.f., in which great stress must be placed on parts tests, in order that the overall performance may be held uniform, yet without requiring unduly long periods of adjustment on the completed product. The desired response characteristic of the entire r.f. amplifier is secured by means of a combination comprising a pre-selector with inductive coupling and an r.f. transformer having both low and high tuned primaries. A careful choice of inductances in the two primaries, together with accurate tuning of the "high" primary, produces a response sufficiently enhanced at the low frequencies to combine geometrically with the opposite type of characteristic produced by the pre-selector. It follows that such an overall curve may *only* be maintained by correct values of both the pre-selector "mutual" and the r.f. transformers high primary tuning condenser. The rapidity with which such a curve alters its slope by slight changes in either or both of the parts named and the degree of change has been most thoroughly studied; the net result can only be a greater determination to hold these parts within narrow limits.

The total dissimilarity of the three couplings, with respect to loading, requires that such parts be measured under conditions simulating those in the receiver. Accordingly, antenna load of a predetermined value and tube plate circuit load are used, respectively, in the selection of these coils. The high primary of the third coil must also be shunted, while measured, by its carefully chosen fixed condenser. When the above conditions are fully met, and an accurately phased variable gang condenser is connected, the nicety with which such an amplifier tunes, and the extreme "flatness" of its gain-frequency characteristic fully justify the labor spent in the checking of its parts.

No expensive equipment is required—only good design. It naturally follows that such work on receiver parts must be done quickly and by ordinary skilled labor, regardless of the limits set by the engineer. To do so requires, more than anything else, a little unusual care and precision in the measuring equipment and its design. A considerable amount of such equipment, rugged and not of particularly expensive construction, is used in the checking of parts employed in one type of superheterodyne now available, and is shown in one of the attached photographs. Note that complete screening is used to avoid interference with other equipment through

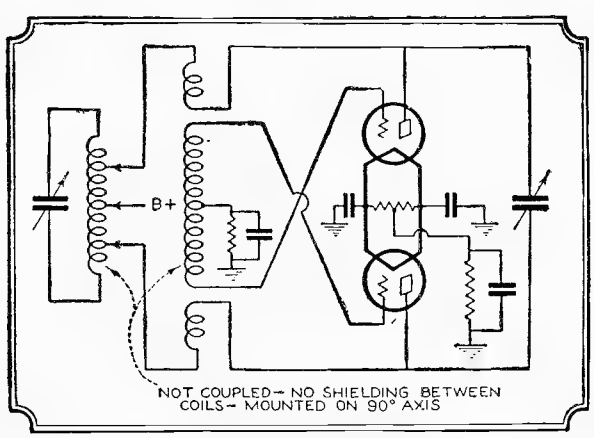
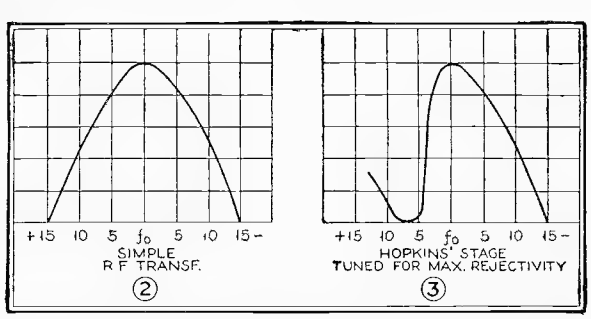


Fig. 1. A push-pull oscillator circuit used in coil measurement work



The comparative resonance curves of a simple tuned transformer (2) and the "Hopkins" stage employed in the superheterodyne illustrated above

THIS article illustrates what goes on behind the scenes in a modern radio receiver manufacturing plant. For similar subject matter readers are referred to the current and recent issues of RADIO NEWS, particularly the August and September issues.

RECEIVER PARTS

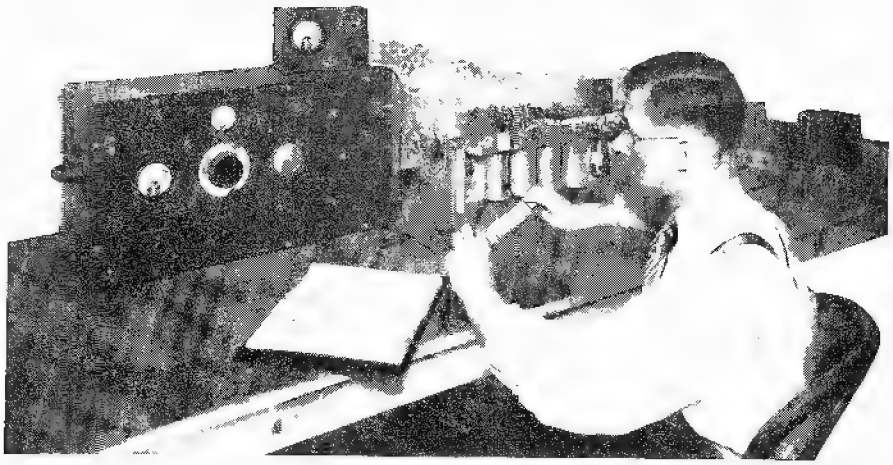
By E. K. Oxner

Chief Engineer, High Frequency Laboratories

the creation of beat notes, yet without hampering the operation by cumbersome shielding of the part under test.

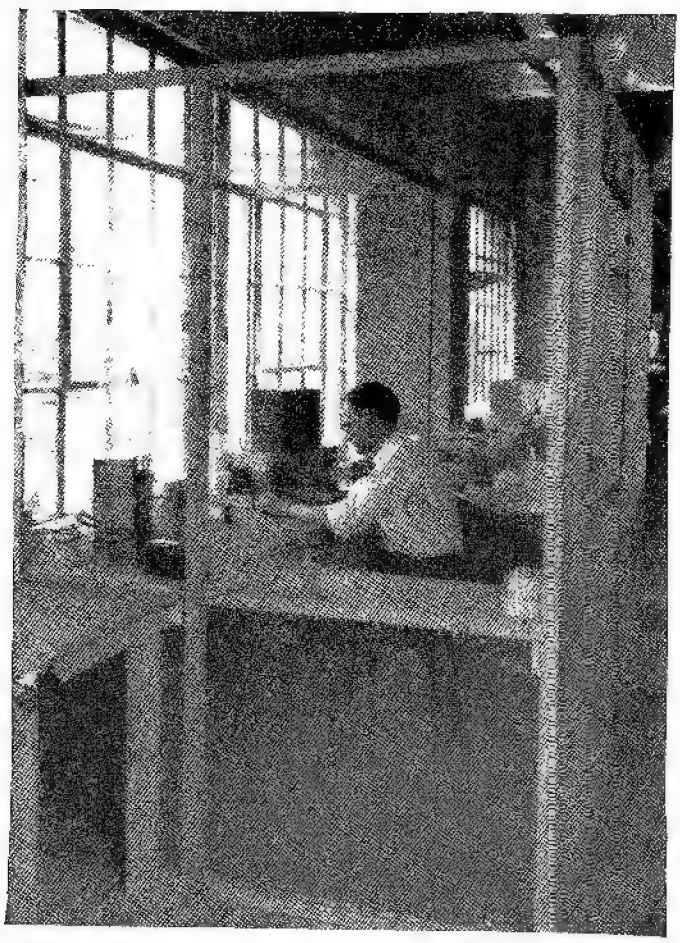
A simple type of oscillator is used for both sides of the zero-beat device used for phasing the gang condensers and checking values of small fixed condensers. This is permissible due to the short time interval on such operations resulting in a minimum error due to frequency creeping. Calibration is such that the "difference" scale is one inch in linear length per ½ mmfd., which is of great value for speedy yet accurate phasing to limits of approximately 1 mmfd. in 420.

For coil measurement, however, such simple oscillators have their drawbacks due to "creep." In this work, use is made of push-pull oscillators, whose fundamental diagram is given in Fig. 1. Due consideration was given to the possibility of using crystal controlled oscillators, but it was found that the "creep" of the push-pull type, when correctly designed, was so small as to be negligible. It may, of course, be tuned to any desired frequency by means of the two condensers.



A typical laboratory set-up

By means of an ingenious drip-wick system, using several small paint pots, a "dot" of color is used to distinguish all parts tested. Thus, both the assemblers and inspectors may note at a glance, the exact tolerance limit of any part of the receiver requiring close limits. An adequate supply of check standards are supplied by the engineering laboratory and are kept in a lock box in measurement booths. Such standards are checked in the laboratory at intervals at the discretion of the engineer in charge. Intimate contact between parts check and final receiver test, is essential in order that limits be held sufficiently close. The same careful check is necessary on parts used in the i.f. section of the receiver. A study of the resonance characteristic of the Hopkins stages, which were described in *Radio News* for August, will disclose to the reader how little mistuning may be tolerated if the band shape and gain are to be maintained. Figs. 2 and 3 show in fundamental form the comparative resonance curves of the simple tuned transformer and the Hopkins stage. Resonance in both is denoted by Fo; in the case of the simple stage, mistuning in either direction could be tolerated to a considerable degree, say to a point 5 or 6 k.c. removed (at 175 k.c.), without too disastrous loss of amplification; a like amount of mistuning in the Hopkins stage of Fig. 3, if in the one direction, would cause serious side-band asymmetry, in the other, a complete loss of signal. Practical considerations prohibit the tuning of such i.f. stages by means of large variable elements which could be used to correct for wide tolerances in parts. It is therefore increasingly important that *all* parts be carefully measured for the job which they have to perform. In the case of the i.f. amplifier (Hopkins) pictured here, tuning coils are held to limits of less than 10 units in 1400; fixed tuning condensers to limits of plus or minus 1 percent; choke coil natural periods to an extremely close tolerance. The latter test is unusual, considering the wide latitude usually allowed the ordinary types of coils used as r.f. chokes.



Working inside a screened booth to prevent unwanted pickup of stray interfering signals

Repeated checks are made on complete i.f. amplifiers without the r.f. input system, in order to determine the degree of change in characteristics brought about by the daily tolerance limits set for checking. The 165-185 k.c. generator, together with the test i.f. amplifier frame, are shown in the accompanying photograph. No variable frequency-modulating equipment is used for this work, the 30 percent modulation at 400 cycles, supplied by the generator, being sufficient for comparative measurements.

In connection with the push-pull oscillators of the type mentioned for coil checking, it is interesting to note their adaptability to performance test of complete receivers, due to their practical absence of frequency shift. One unit of three such oscillators is now in use for securing, on the test bench, an immediate indication of the degree of rejectivity of the receiver under test.

In the particular case, the standard demanded, as determined by complete signal generator test, is a rejectivity of 1000 to 1 at 10 k.c. from the resonant frequency on either side. The three oscillators, each of the push-pull type, each modu- (*Continued on page* 644)

For the Motor Workshop

By Raymond B. Wailes and Frank W. Bentley, Jr.

Do You Want to Improve Your Home Workshop? Here Are Authentic Kinks for Motor Equipment that Will Aid You Materially

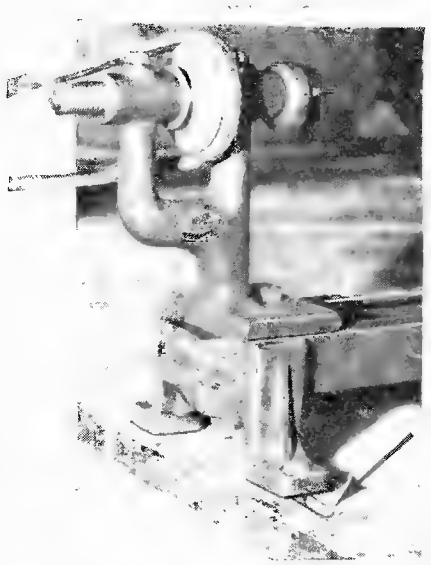
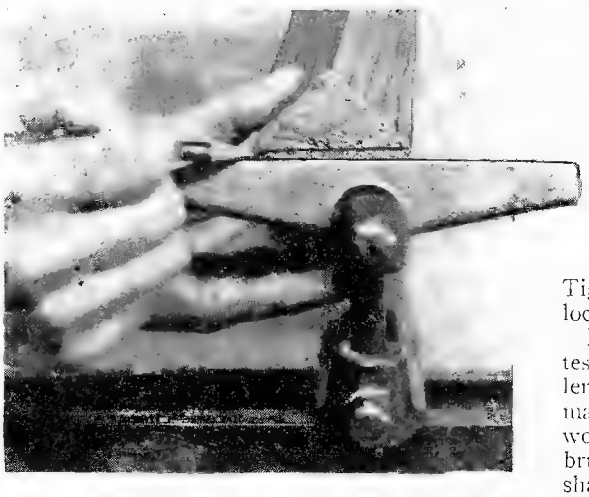


Fig. 2

FIGURE NO. 1—The workshop motor can be controlled from any point about the workbench if a shaft device is installed over the bench. This can be done by mounting a double pole single throw porcelain base switch overhead and affixing to the fibre handle two dowel sticks which pass on either side of the switch and are suspended from the ceiling of the shop. Thus two sticks, each three feet long, will present an area six feet long from which the motor switch can be operated. The shaft thus formed can be operated with one hand without taking the eyes up from the work. While dowel sticks are suggested, light strips of square cross-section can be used equally well.



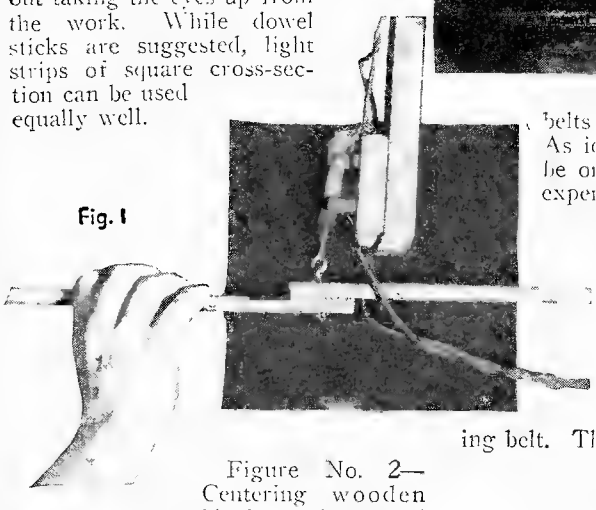


Fig. 1

Figure No. 2—Centering wooden blanks to be turned in the lathe is best accomplished by marking two lines across the ends, the lines passing through the opposite diagonal corners. The tool rest makes an ideal straight edge for this purpose.

Figure No. 3—A tool rack to be fixed in an upright position on the rear edge of the motor bench will be found very useful. It consists of a wooden panel mounted to the bench top by means of shelf brackets. The panel is useful in holding rag wheels, scratch brushes, emery wheels, lathe wrenches, calipers, pulleys, rule, belting dust brush, etc. Turning tools and a screwdriver can be held in a shelf mounted on the front of the panel. Drills can also be retained here.

Figure 4—The problem of loose driving belts on small motor workshop equipment is, at times, very serious. Due to the small diameter of the pulleys, grippage is at a minimum, and belts must be kept very tight. As idler pulleys do not seem to be on the market for small, inexpensive motor shops, another means of keeping belts tight is needed.

Slotting the holes of the motor bench through which the hold-down bolts of the lathe, saw, planer and other devices pass, affords a ready means of adjusting the play in the driving belt. The nuts underneath the table are supplanted by wing nuts, and the machine itself is actually moved forward or back to tighten the driving belt. Tightening the wing nuts securely locks the device in position.

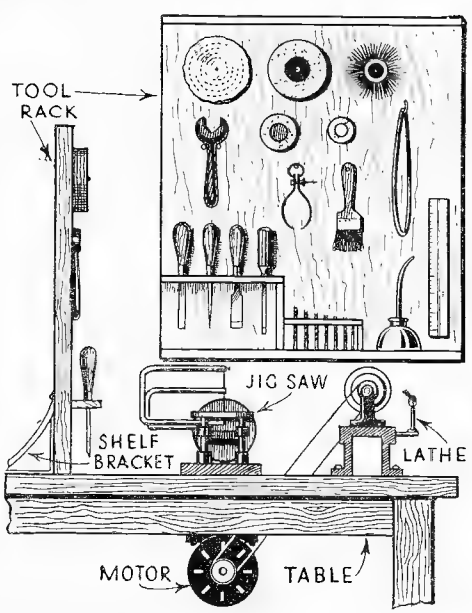


Fig. 3

Fig. 4

Figure No. 5—Wire bottle, or test tube brushes cut in short lengths and fitted in the drill chuck make excellent brushes for interior work. A five-cent hand scrub brush can be cut into a square-shaped brush *with a hack saw*, mounted upon a bolt and revolved in the chuck for cleaning and polishing.

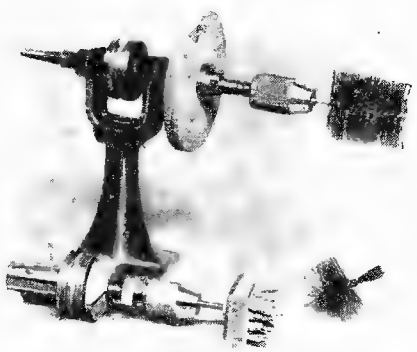


Fig. 5

Figure No. 6—Quite recently a small bearing was needed for the end of a light shaft. An old automobile engine piston was quickly sawed away and shaped into one as shown. One of the wrist pin bosses was run with a bit of babbitt for the shaft end, and the top of the piston was cut into a tail like portion which was drilled for screws and fastened down securely.

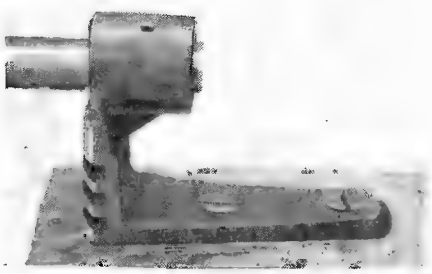


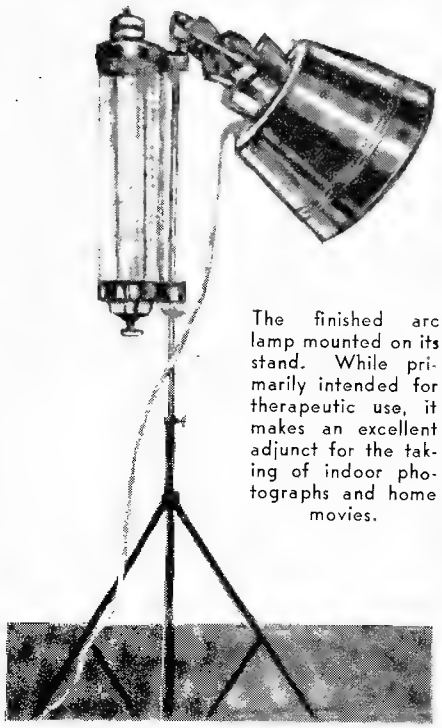
Fig. 6

Artificial Sunshine from a Home-Built Lamp

By Lionel K. Arnold

Engineering Experiment Station, Iowa State College

This Article Describes the Building of an Arc Light for Providing Ultra-Violet Rays for Therapeutic Purposes. It Is Thoroughly Practical and Easy to Build



The finished arc lamp mounted on its stand. While primarily intended for therapeutic use, it makes an excellent adjunct for the taking of indoor photographs and home movies.

"SUNSHINE at the turn of a switch," is bringing health and happiness to thousands. No longer is it necessary to go to the sun to receive the blessings of its health-giving rays. The magic ultra-violet rays are being brought into American homes by various makes of therapeutic lamps. Physicians everywhere are prescribing ultra-violet light for various diseases. The ancients recognized in a general manner the value of sunlight, but it remained for modern science to establish it in a definite way and to design equipment for furnishing the beneficial portions of the sunlight to the patients.

We think of sunshine in terms of the light it gives, but strangely enough the invisible rays of the sunshine, the short ultra-violet and the long infra-red rays, are the health-giving rays. They are particularly valuable in such diseases as anemia, rickets, neurasthemia, endrocrine disorders, neuritis, tuberculosis, and delayed sex development.

To obtain the benefits of ultra-violet treatments one need not purchase one of the expensive machines on the market. A simple machine built by the writer at the cost of a few dollars has been used with excellent results in successfully treating a bad case of anemia. This machine is of the carbon arc type which has been found by the Bureau of Standards to be the nearest approach to true sunlight. In order to secure the maximum efficiency, a double arc consisting of two arcs in series was used. If only one arc is used it would be necessary to add additional resistance to regulate the current to the proper amount and actual power consumption would be practically the same, while the effectiveness would be only one-half as great.

The regulating mechanism of the arc is shown in Figure 1. The parts are as follows: L is made from a piece of strap iron or steel ⅛ inch thick, 1 inch wide, and 17 inches long, bent into shape as shown. The piece B is made from a similar piece of steel 7 inches long and bent to shape. It is fastened to L with small bolts or rivets. F is a piece of fiber or other suitable insulating material 3 inches long, 1½ inches wide, and 3/16 inch thick. It is fastened to L by the pieces P which are made from strap iron. F is bolted to P which is bolted to L. The purpose of F is to support the holders for the stationary center carbons. These holders shown at J are made from ¾ inch brass rod, ¾ inch long. A hole ⅜ inch in depth and 5/16 inch in diameter is drilled into one end. A hole is drilled at right angles into this hole and tapped to take a small machine screw (such as 10-24, or 8-32) used for holding the carbon in place. In the opposite flat end, a hole is drilled and tapped to take a small screw used to fasten the holder to the fiber piece F. The two holders are connected together electrically by a strip of sheet brass placed between them and the fiber. The movable carbon holders are made in the same way except that they are 1⅝ inches long. They are fastened to the fiber pieces M which are 1½ inches by 1 inch by 3/16 inch. M is bolted to the small hinge 1 inch in width. The hinge is bolted to the piece N. N is merely a rectangular piece of 24 gage sheet iron, 2⅜ inches by 1 inch, bent over at right angles ½ inch from each end. N is bolted to the center of the cross piece B. The piece G is made from sheet iron of the same weight and is shown in Figure 2. It is bolted to M between it and the hinge. Two links H of sheet iron are connected at one end by a pin or bolt to G, and at the other end to the piece O. A piece of wire is coiled around the pin at G to hold the links apart. The hole in piece O is threaded to correspond with the threads on the rod W. This threaded rod has the ends filed down to a smaller diameter so that they fit in holes drilled in pieces B and P in such a way as to be readily turned. K is a wheel of iron, wood, or any other suitable material. It is held in place on the rod by lock nuts so that when turned the rod

(*Continued on page 654*)

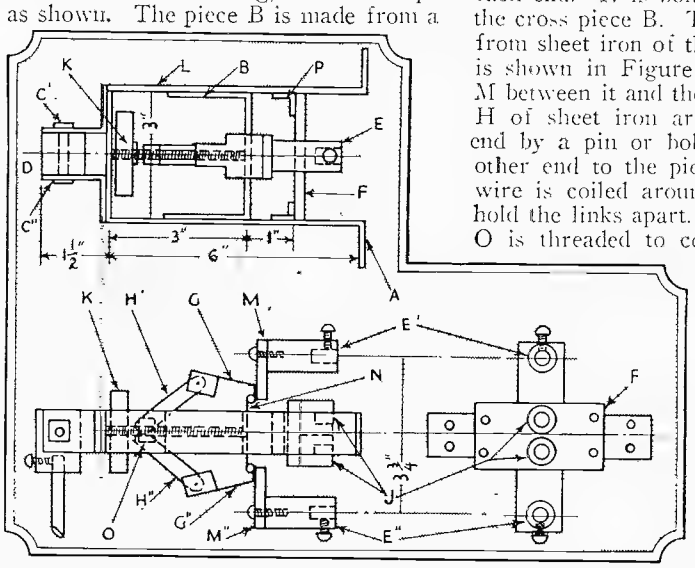


Fig. 1

The details for the construction of the carbon holders are indicated in this diagram.

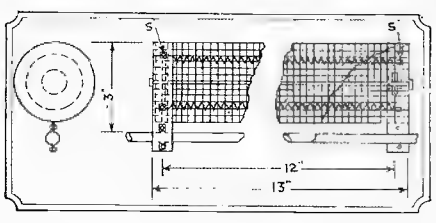


Fig. 3

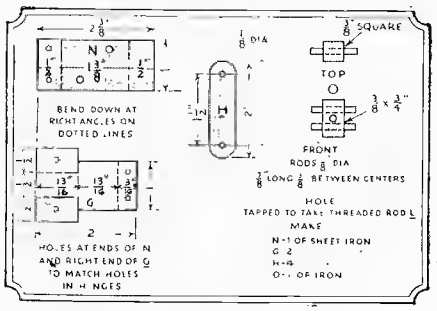
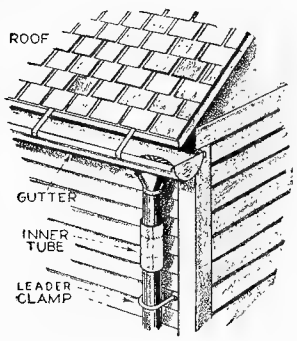


Fig. 2

Wrinkles and Recipes

Leader Repaired with Inner Tube

A SHORT section of leader pipe became rusted out, and as I did not have a length of pipe to make a repair, I cut a piece of automobile tire inner tube. The free ends were slipped over the parted ends of the pipe and drawn tight. The elasticity of the tube made the slipping on very easy and resulted in a neat looking joint which held tightly. Rub wet soap on the pipe ends if the tube does not slip on easily.—*Raymond B. Wailes.*

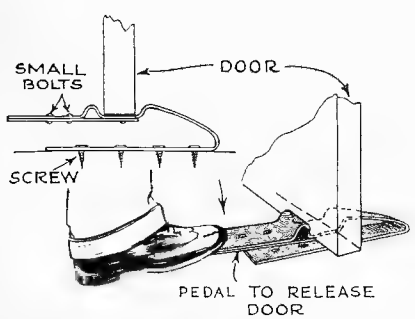


Easy Way to Repair Broken Gear Teeth

WHEN teeth break off, as often happens on pinion and gear wheels, they may be easily repaired by drilling holes, tapping for and screwing bolts in the space where the teeth are broken. By cutting the bolt heads off and filing off the bolts so that they line up with the rest of the teeth and mesh properly a quick and enduring repair can be made.

Place the bolts as close to each other as is possible so that greater strength and surface may be obtained.—*Joseph D. Amorose.*

Holding Doors Open

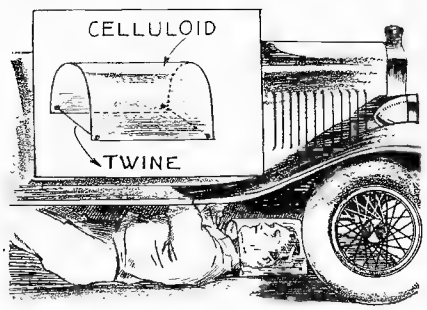


HERE is a simple device for holding doors open. Take a piece of spring metal or tin and bend it as in the illustration. One inch is a good width. When you want to close the door press the strip with the foot as shown; this will release the door for closing.—*McKee Smith.*

First Prize, $5.00

Dirt-Proof Mask for Working Under a Car

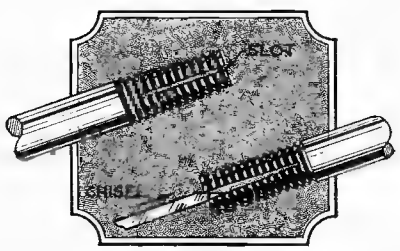
THIS celluloid mask fits over the face and when working under an automobile prevents sand and grit from getting in the eyes.—*W. T. Mason.*



Paper Pocket Lining

ONE who travels or goes on an outing often carries pieces of gum in his pocket, or cigarettes and candy. This sometimes causes stains in his coat pocket. To remedy, he can take an ordinary paper bag the width of his coat pocket and cut it to about five inches in length. The bag is then inserted into the pocket and no attention need be paid to it. Candy, cigarettes, etc., can then be placed in it with perfect safety. The paper bag can be discarded and a new one replaced whenever necessary.—*Frank Schmulowitz.*

Tightening the Loose Nuts

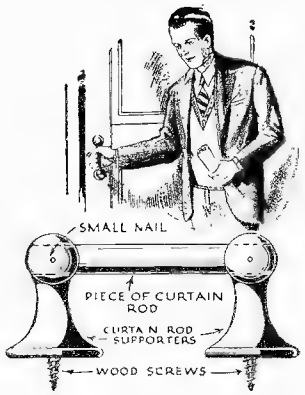


SOMETIMES threads of a bolt and nut become so worn that they are practically useless, and when another set is not easily obtainable, the trouble can be remedied by the method shown; by sawing a slot in the bolt with a hacksaw and spreading the threaded part with a chisel.—*Joseph D. Amorose.*

$5.00 is paid each month for the best Wrinkle or Recipe accepted and published in these columns. All others used are paid for at regular rates. Address: Editor, Wrinkles and Recipes.

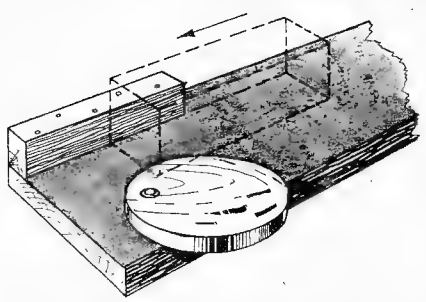
Door or Drawer Handle

A STURDY and attractive handle can be made out of a pair of curtain supporters and a piece of curtain rod. The supporters are provided with screws by means of which they can easily be fastened to a door, the top of a home-made tool-box, or any other place where a handle of this type is suitable. A piece of curtain rod of sufficient length is inserted and fastened in with small nails, as shown. It may be secured by soldering or sweating.—*F. S.*



Quick Acting Vise

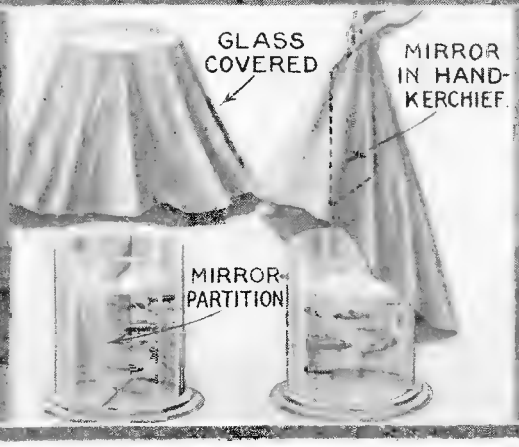
QUITE often it is necessary to hold a board firmly, especially is this the case when planing. A short piece of 2″×4″ wood is nailed flush with the edge of a plank the size of which is immaterial. A piece of 2″×8″ wood about six feet long is very convenient as it can be carried to the job, placed upon a pair of wooden horses or boxes, and will be ready for work. Next cut an inch board into a circle with a diameter of six or eight inches. This piece as illustrated is circular; if you prefer it may be made as a half circle. Fasten it with a screw and washer to the plank. The screw is placed near the edge of the circle; this allows the circular piece



to move as an eccentric cam toward the 2″×4″ block. The vise is used as follows: insert the board you wish to hold between the block and cam, push in the direction indicated by the dotted arrow and it will automatically be clamped firmly. To release push the board in the opposite direction.—*Eugene Keyarts.*

(*Continued on page* 664)

MAGIC



Mystic Fish Story

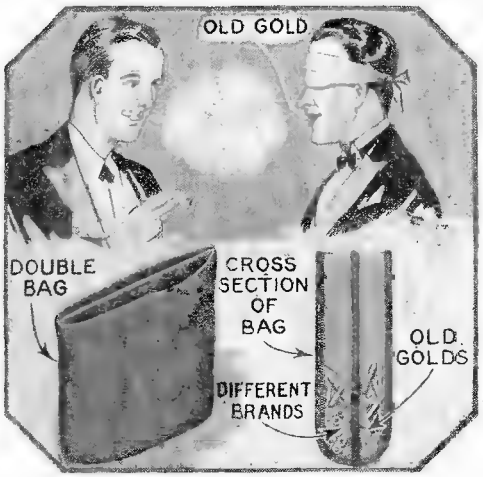
A LARGE transparent glass cannister filled nearly to its brim with nothing but water is covered by a borrowed handkerchief. After a few moments, the handkerchief is removed, when to the amazement of the spectators a dozen or more goldfish are found to be swimming about in the water. The secret lies in the fact that the cannister is divided by a piece of glass mirror. The reflecting side is toward the audience. The fish are concealed behind the partition. When the handkerchief is removed, the glass is withdrawn and disposed of by being left on the table top while attention is called to the fish.

A Fortune in Eggs

A TRAY of eggs, all unprepared, is passed for inspection. The magician then removes a pencil from his pocket, cracks the egg with it, and then withdraws a twenty dollar bill from the interior of the egg. The trick requires a little preparation. A clutch pencil is fitted with a spring that pushes a rolled bill out of the hollow top. A bayonet catch secured to the piston holds the spring in place until, at the opportune moment, it is released and a rolled bill is forced into the interior of the cracked egg. An unprepared pencil similar to the one used for the effect should be available in case examination is requested.

By Hunninger *

The master mind of modern mystery, who has mystified Ex-Presidents Harding, Taft, Roosevelt, Coolidge, the Prince of Wales and other celebrities



The double bag permits of an ingenious blindfold cigarette test.

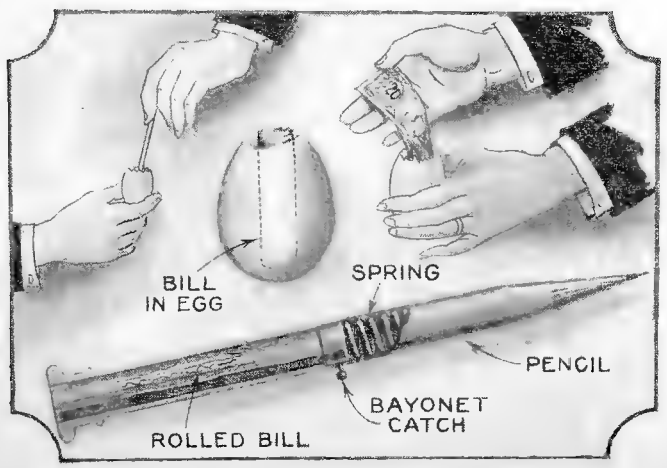
Naming a Cigarette

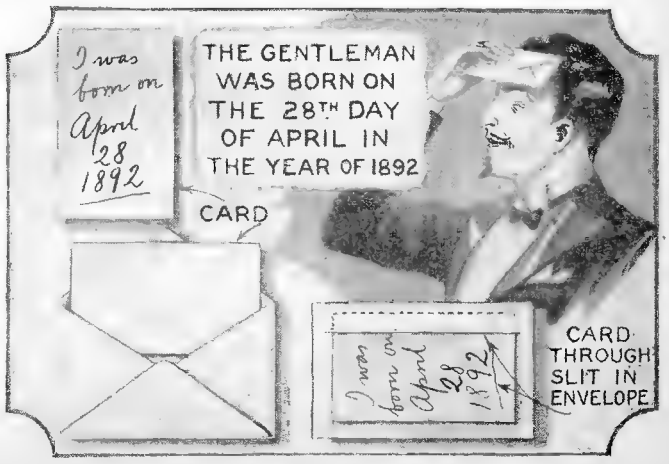
THE magician asks the spectators to drop cigarettes into a bag, and he will demonstrate an ingenious blindfold test. The cigarettes are called aloud as they are accumulated, Camels, Chesterfields, Old Golds, Pall Malls, Fatimas, Murads, Melachrinos, and many of the other brands that will be found in a well packed house. The magician is now securely blindfolded, and a spectator is asked to pick out any cigarette from the bag, light it and blow a puff of smoke in the direction of the magician, who may be standing eight or ten feet away. The magician correctly names the brand. The secret lies in the fact that the bag is double. On one side of the partition ten or twelve Old Gold cigarettes are secreted. The spectators drop their cigarettes in the opposite side of the bag, but the one which is chosen comes from the first mentioned side and must, of course, be one of the cigarettes previously placed therein by the performer.

Second Sight

THE magician requests that the spectator take one of his own visiting cards and write a date, number or name upon it, while the magician walks away. This card is then taken from the spec-

(*Continued on page* 663)

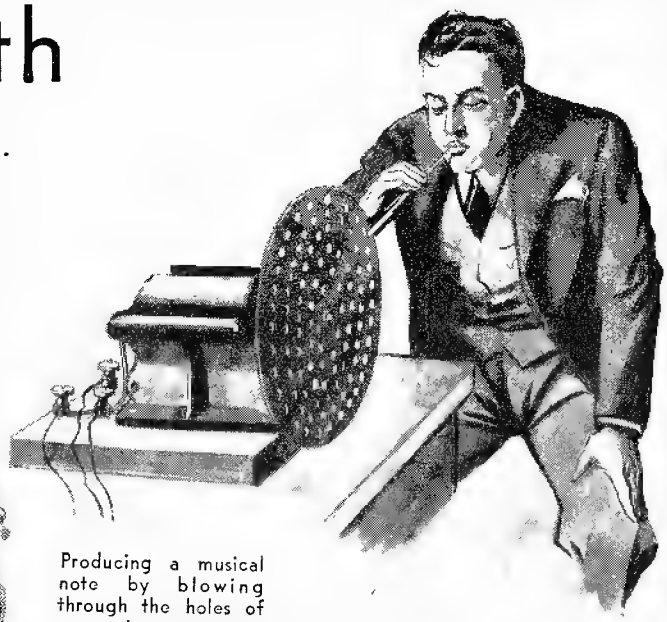



I was born on April 28 1892
THE GENTLEMAN WAS BORN ON THE 28TH DAY OF APRIL IN THE YEAR OF 1892
CARD
CARD THROUGH SLIT IN ENVELOPE

Experiments with Toy Motors

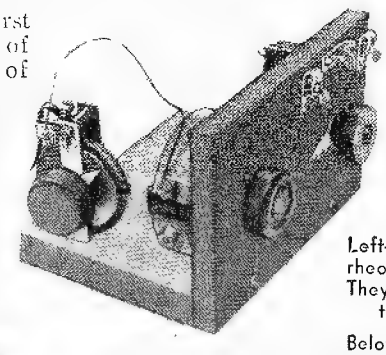
By Raymond B. Wailes

The Author of this Article Is a Veritable Mine of Ingenuity in the Experimental and Home Work Shop Field. This Series of Toy Motor Experiments Will Attract Every Electrical Amateur Among Our Readers



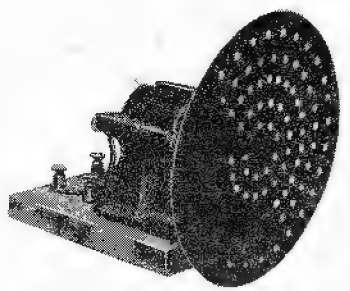
Producing a musical note by blowing through the holes of a moving paper or phonograph disk.

PERHAPS one of the first desires of the possessor of a battery motor is that of varying the speed of the motor. This was simply and easily accomplished by means of a rheostat inserted in series with one of the battery leads. Radio

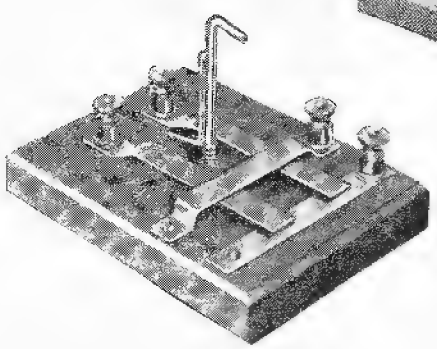


Left—A series of obsolete radio rheostats arranged on a base. They are to be used to control the speed of a toy motor.

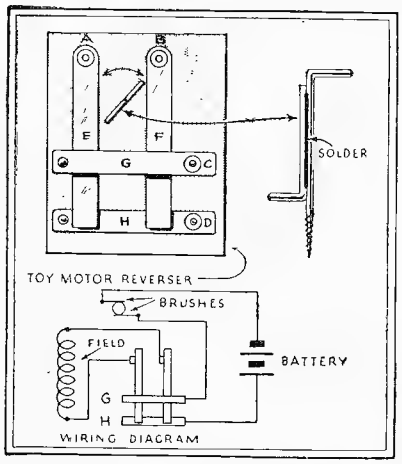
Below—Diagram of the reversing switch and method of connections.



Holes drilled in a phonograph record produce a musical note when a current of air is directed toward them through a soda straw or rubber tube, when revolving.



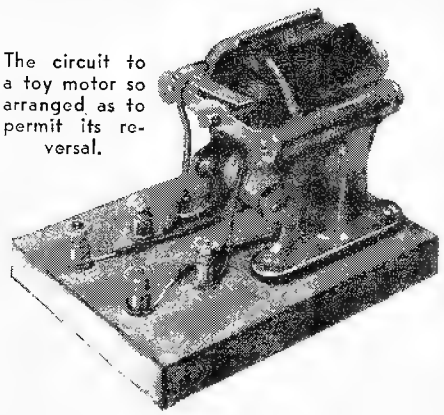
The completed reversing switch, made from a few metal strips, several binding posts and a wooden base



rheostats mounted on a wooden base or behind a wooden panel mounted upon a base make a serviceable resistance group by which motor speeds can be controlled.

That of reversing the motor is often a problem to some. Simply reversing the battery leads will not bring this about. However, by mounting the motor on a wooden base and fixing four binding posts upon the base, two posts being connected to the brushes and the remaining two to the field, results in a combination whereby the direction of rotation can be varied at will. In making these connections, the present series field connections of the motor are abolished. In the series-field connection, one end of the field winding of the toy motor is connected to the battery, the other free end of the field winding connects with one of the brushes, and the remaining brush connects with the remaining battery terminal. In the four binding post method, the field to the brush wire should be disconnected. The now free wires should then be connected to two binding posts and the two brushes, connected electrically to nothing else, should be led to the other two binding posts. To operate the motor, run battery wire to one field binding post, the other battery wire to one of the brush binding posts and then connect the free binding posts with a wire. By a simple reversal of either ONE battery wire to the other corresponding connection, or end, and connecting directly the free binding posts, the motor will reverse.

Rigging up a toy motor for operation from 110 volt lines.

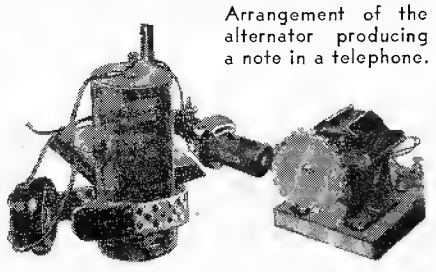


The circuit to a toy motor so arranged as to permit its reversal.

In this manner, the battery current reverses through either the field or the armature (through the brushes), but never reverses through both the field and the armature at the same time to cause a different rotation.

A reversing switch can be made from copper strips. Bend and mount strips as shown in the sketch. Strips E and F are somewhat like telegraph keys and in the normal, or up, position make contact with strip G. When either one is depressed, this depressed strip makes

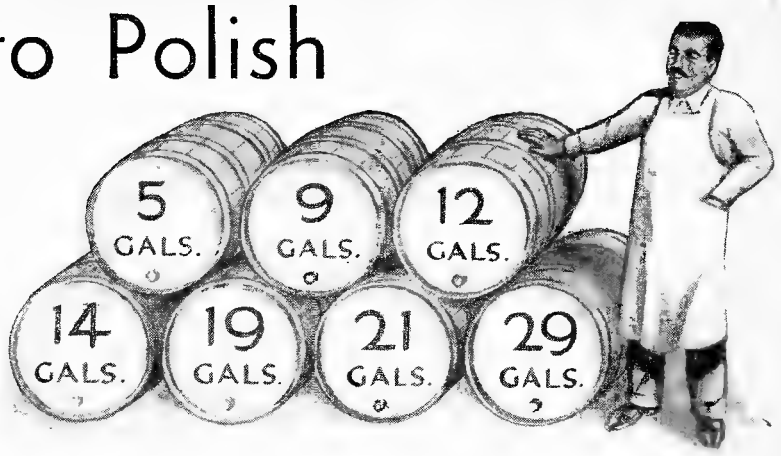
(*Continued on page* 645)



Arrangement of the alternator producing a note in a telephone.

Prize Puzzles to Polish Your Wits

By Sam Loyd



THE Puzzle King presents the eleventh of a series of problems, the solving of which will show if your mathematical ability is bolstered up by logical reasoning. Prize winners of the August puzzles and solutions will be found on page 656.

TWENTY-FIVE DOLLARS IN PRIZES

A FIRST PRIZE of $10 will be awarded to the person sending correct answers to the five puzzles accompanied by the best expressed analyses of the Oil and Vinegar Problems:

A SECOND PRIZE of $5 will be awarded for the next best analyses and correct answers to the five puzzles.

TEN PRIZES of $1 each will be awarded to the ten persons who send the next best analyses of the Oil and Vinegar Problems together with correct answers to the five puzzles.

Answers must be received not later than noon, November 15, addressed to "Puzzle Editor," SCIENCE AND INVENTION, 381 Fourth Avenue, New York City.

All contestants must abide by the decisions of Sam Loyd, who will examine all papers and award the prizes.

Papers of identical merit, tying for any one of the prizes, will each receive the full amount of the prize tied for.

Speculating in Oil and Vinegar

WHEN Tony Bacciagalupo bought out Angelo Frascatti's stock of oil and vinegar, for an even hundred dollars, the two merchants took inventory and found the quantities of liquids as shown in the sketch. Each barrel is marked with the number of gallons it contained.

Tony believes in quick sales and small gains, so at bargain prices he realized a nice profit by speedily clearing out the entire stock, with exception of one barrel, which barrel remained untapped at the time of our interview. He had a flat gallon price for his oil, which was three times as much as he asked for vinegar, and with six of the barrels sold out, he had taken in like amounts of cash for each of the liquids.

Tony told me many interesting things about oil and vinegar, and also imparted some confidential advice as to what one could do with a barrel of grape juice. However, since this is a puzzle discussion, let us confine our attention to the facts already set forth.

As related, after taking in the same amount of money for each liquid, and charging three times as much per gallon for oil as for vinegar, Tony had emptied all but one of his barrels, which barrel remained untouched.

Now, here is where the puzzle comes in. I offered Tony four dollars for the contents of that remaining barrel, and he snapped me up, although I got the stuff 20 per cent. cheaper than did the other customers.

Which of the liquids did I stock up on, and what profit did Tony realize on his turning over of the seven barrels.

Another Puzzle from Tony

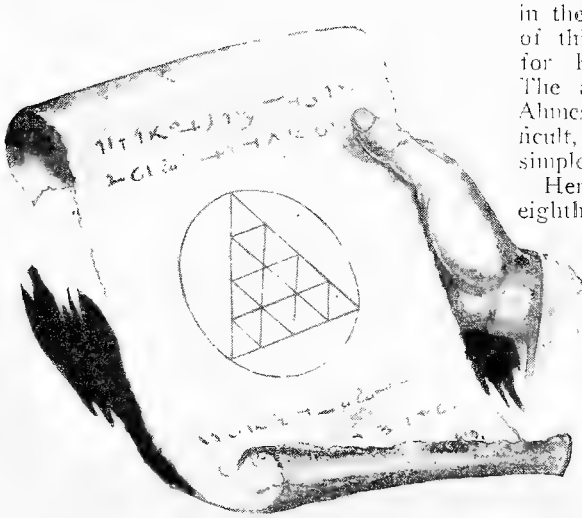
WHILE investigating the oil and vinegar business, let us consider another problem picked up at Tony's.

It seems that in bottling up a full barrel of vinegar, Tony used three measures in decanting the 31½ gallons. He drew five times as much vinegar with the 3-qt. measure as with the 2-qt. measure, and the only other measure used was the 5-qt. one.

Since he drew only full measures, who can tell how much he drew off with each of the three measures?

The Seal of Ahmes

THE most ancient puzzles of which we actually know the author's name date back to 1500 B.C. These are contained in an Egyptian papyrus reposing in the British Museum. The title of this prized relic is, Directions for Knowing All Dark Things. The author was a priest named Ahmes. His puzzles were not difficult, since they dealt mainly with simple arithmetic.



Here is one of them, which an eighth grade pupil should solve in a jiffy.

"Find a number which, when added to its seventh part, equals 19."

A feature of the Ahmes document which strikes me as being much more worthy of our attention, is a symmetrical design which appears throughout the work in the nature of a seal, or signature.

As shown in our sketch, this symbol is composed of a group of triangles within a circle.

From this graceful figure we deduce two natural puzzles, as follows:

First: How many different triangles can be counted, that is—the total number of triangles, large and small, that can be found within the circle?

Second: In how few strokes of a continuous line (counting the circle as one) can the figure be drawn; it being permitted to retrace parts of the design?

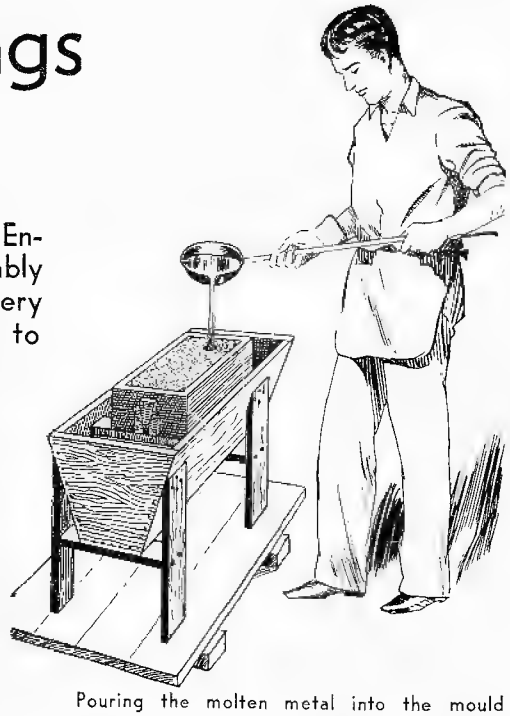
Thus three problems, gleaned from the musty records of Ahmes. The first, that little arithmetical question, should be solved mentally to lubricate the mental mechanism for digestion of the other two posers.

At the top of answer sheet, state the number of triangles. Also set down the total number of strokes required to draw the symbol.

Make Your Own Castings

By L. K. Wright

A Very Large Number of Otherwise Keen "Make It Yourself" Enthusiasts, Who Literally Do Make Everything Themselves, Invariably Balk at the Prospect of Making Their Own Castings. Like Every Other Job, of Course, There Is a Knack in It, and a Few Tricks to Be Learned



Pouring the molten metal into the mould

A GREAT many "how-to-build-it" articles very easily skip over the casting problem by advising the constructor to "take the pattern to the foundry" so that the required number of pieces may be cast. To the builder familiar with casting practice this is superfluous advice, but to those not cognizant of pattern and founding procedure such a single sentence of instruction on this subject is the bugaboo which deters many from constructing the models they are anxious to build.

Patterns form the most expensive part of the production of castings. Once a pattern is made up almost any number of castings may be cast by the use of it. The cost of casting is so reasonable that it does not pay to attempt to provide the metal and apparatus to pour them in the worker's own shop, unless they are of the low melting point metals, such as the tin, lead, bismuth and zinc alloys. The low melting point alloys are suited to small experimental parts and after proving the piece by a test fit the pattern thus checked may then be used for an iron or brass casting.

Iron castings range from five to fifteen cents per pound, brass and bronze from thirty to sixty cents and aluminum from forty to seventy cents per pound. Small intricate castings cost a great deal more than large simple ones, but on the whole the prices are usually very reasonable.

To make small castings about one or two cubic feet of fine moulding-sand will be required, which will be sufficient for most experimenters. This material may be purchased from a foundry supply house, the foundry itself or obtained by a dealer in hardware. If it is possible to obtain the yellow sand it will be found to serve better than the black material generally employed, but the latter will serve, as it does in thousands of foundries.

Should the amateur decide to find his own sand, preference should be given to the finest material, which clings together in a solid cake when a damp mass of it is compressed between the hands. Common river, lake or ocean sand is not suitable as it is too coarse and will not hold its form.

In order to prevent the sand from getting on the floor and being tracked about the place it is best to construct a moulding-table. While an ordinary bench or table will do it will be found that convenience of working at a moulding bench, of the type shown in Fig. 1, will more than offset the labor necessary to build it.

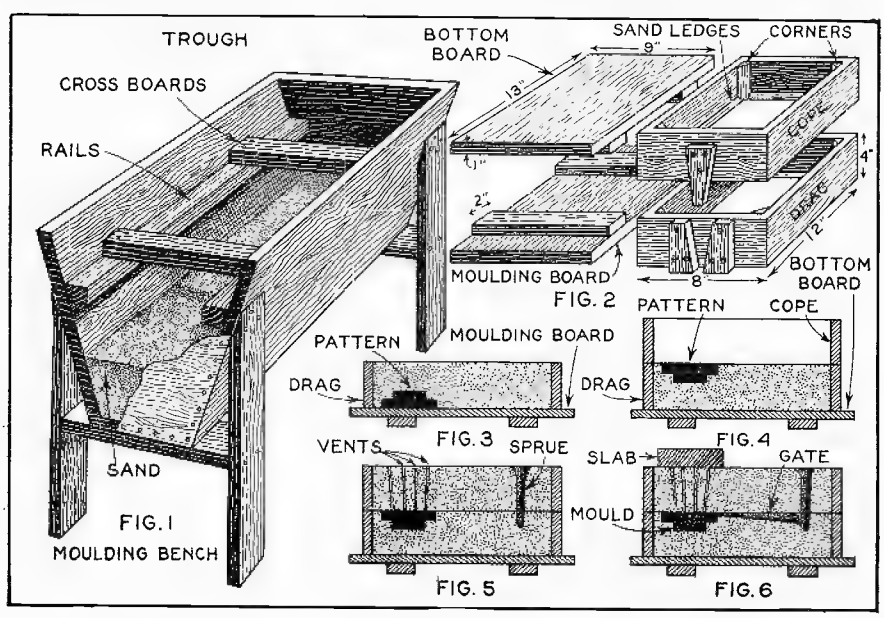
Since the bench is subject to considerable pounding it is best to construct it of one-inch material, fastened with screws, so that the joints will not open. Two rails should be screwed to the front and back boards inside the trough so that the cross-boards, which in turn support the mould, may be easily shifted. By sliding the mould with the cross-boards the sand below is easily available. Fig. 1 depicts the general form of a suitable moulding bench, and conveys more concrete information than would a page of text.

A few simple tools will be required for handling and preparing the sand. A small shovel or scoop may be used for filling the moulding box or "flask." Whether sand is new or used over and over again it is best to make a sieve of ordinary wire screeen. A piece of wire netting fastened to a box or hoop makes a good sieve.

A rammer, used for pushing and ramming the sand in place, may be easily made by whittling down a small rolling pin; one end being cut to a wedge shape while the opposite end is leit full size for ramming. The center portion may be thinned to offer an easy grip for the hand. For small work an old teaspoon may be used for working the sand. The above "tools," together with a bag or knitted stocking filled with coal dust, completes the necessary equipment, with the exception of the "flask."

A simple "flask" consists of a rectangular box, cut longitudinally in half and provided with a loose top and bottom. A "flask" suitable for small castings may be made of one inch stock and is best constructed by first making a box about 12″×8″×8″ high, and then sawing it in half, so as to provide two frames. The upper section is called the "cope" and the lower portion is termed the "drag."

Each section is provided with corners and sand holders, screwed in place, the former members serving to strengthen the "flask" and the latter triangular strips to pro- (*Continued on page* 639)

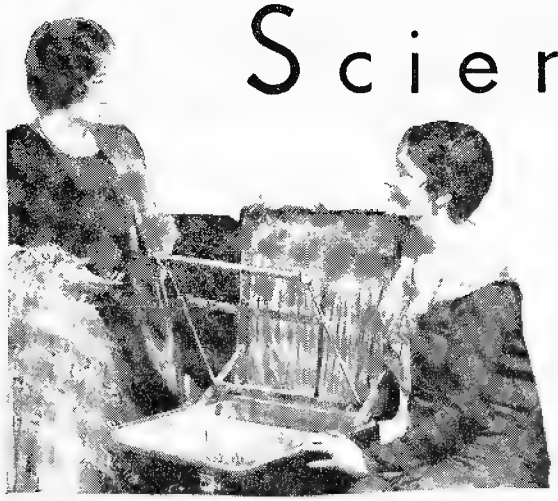


These sketches give all the detailed information required to make a moulding bench and "flask," or container for the sand mould.

Scientific Aids to Your Comfort

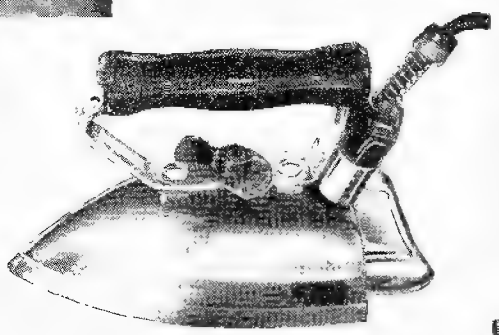
By Mary Jacobs

Are You Getting Full Benefit from the Time and Labor Savers on the Market? This Monthly Page Features the Latest Devices to Lighten Your Work



Keep Your Dresses Straight

WHEN you unpack a grip, it's mighty discouraging to find carefully pressed clothes all wrinkled. The Aviatrix suitcase keeps dresses smooth. . . . Besides the regular compartments, it is equipped with a banded dress-holder, so arranged that clothes are always in a vertical position. The case accommodates from six to ten garments; you merely raise the holder to get them. Priced from $10.00 to $85.00.



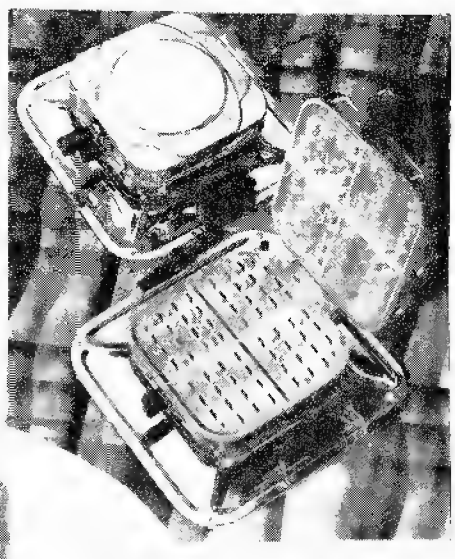
YOU can buy the latest in electric irons for $8.90. The Proctor iron has a complete temperature range up to 250 degrees Fahrenheit for properly pressing linen, cotton, wool, silk or artificial silk. No constant plugging in to warm the iron and pulling out when it gets too warm. Just set the dial marked for your fabric, and correct temperature will be maintained. Tested in our laboratory.

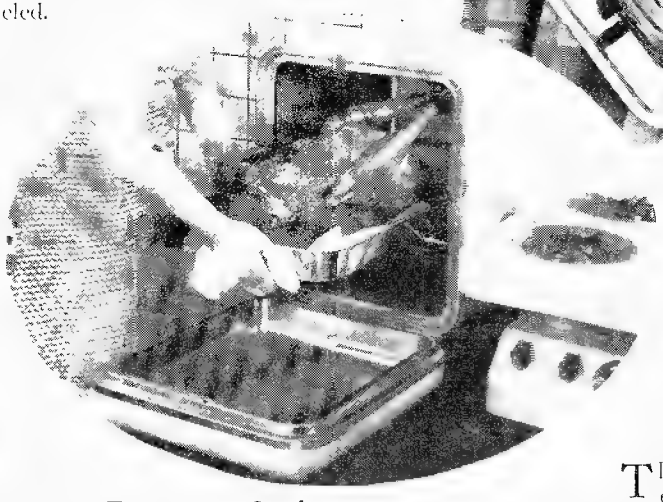
Save Your Hands

STEEL wool is excellent for cleaning aluminum pots. Unfortunately, it chaps your hands. To eliminate this, a long metal handle (the Nu-Brite) which fits into the disc holding steel wool, is being manufactured. Price 10c per package containing steel wool, soap and handle. Tested in our laboratory.

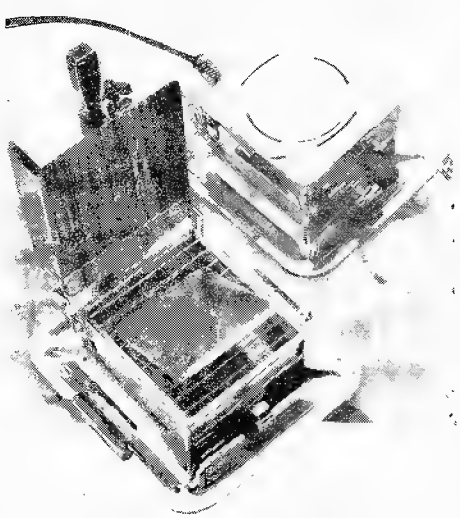
Turn the Switch, and Cook

IF you are tired of a hot kitchen, why not install an Electrochef? Double air-space oven insulation and focused radiant reflectors assure cool cooking, according to the manufacturer. Several dishes can be prepared at the same time by using the oven, and table stove of four burners. An adjustable thermostat maintains constant oven temperature. The oven is constructed of Armco iron, all bare metal finished in rustless chromium, and porcelain enameled.





Upon turning on the current, a red light is flashed. It remains until grids are heated



Toast to Order

THIS automatic toaster prepares any slice of bread, thick or thin, on both sides simultaneously. Heat is adjustable; your toast can be done just as you like it—light, medium, or dark. There is no ticking or popping out; the toaster signals silently by the wink of a light when each slice is ready, then keeps it warm for you. Price $12.50. Tested in our laboratory.

Silent Signal Wafflor

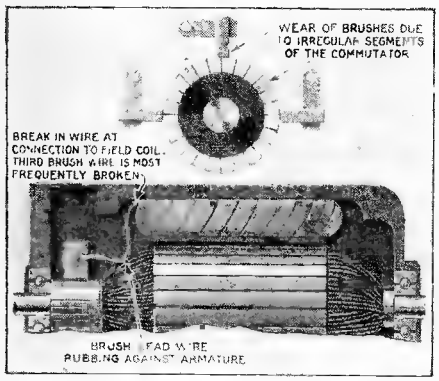
THE Proctor Wafflor eliminates guesswork in baking waffles. Nine intensities of heat are provided for the grids. Waffles can be baked from a very light yellow color to dark brown, crisp ones. When grids are properly heated the ruby light flashes off; when batter is poured it reappears, and remains until the waffles are perfectly baked. It will stay just right till you take out your waffle. Price $25.00. Tested in our laboratory.

Names and addresses of manufacturers gladly supplied upon request

New Ideas for the Owner and Driver

By Arthur George

Every Month New Developments of Interest to the Owner Driver Make Their Appearance, and Are Reported for Your Information and Benefit. The Author of These Notes Is an Authority on Automobiles, and Has a Wide Experience in the Motoring Field


WEAR OF BRUSHES DUE TO IRREGULAR SEGMENTS OF THE COMMUTATOR
BREAK IN WIRE AT CONNECTION TO FIELD COIL. THIRD BRUSH WIRE IS MOST FREQUENTLY BROKEN
BRUSH LEAD WIRE RUBBING AGAINST ARMATURE

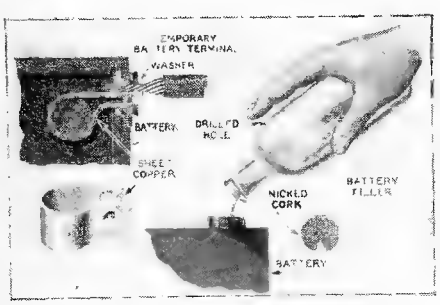
Current Failures

THE absence of charging current will be shown immediately by the ammeter.

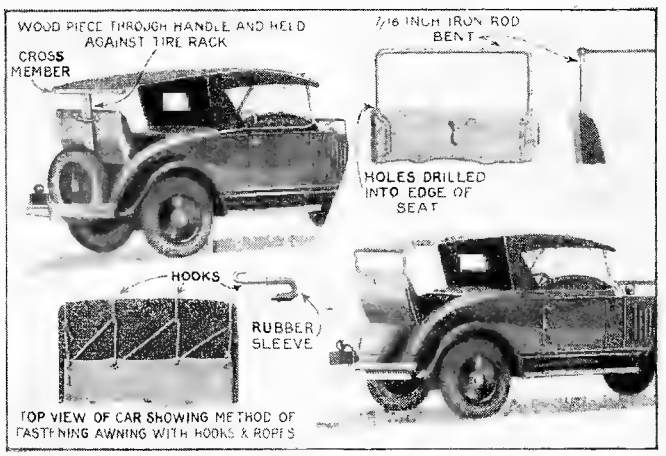
If removal of the cut out cover shows this unit to be out of contact and the contact points will not stay together even after holding them closed, it is probable the fault is in the generator. This can be taken off the engine by loosening one or two bolts. If the segments in the commutator are uneven, the segments should be trued up with emery cloth or on a lathe. Look for worn brushes, which may be too short. If worn, replace with new brushes.

Another cause may be the rubbing of a brush wire or pigtail against the commutator. A piece of insulating tape will possibly be all the repair required unless the wire is cut. The third cause for failure may be a broken wire from the third brush, where it joins the field coil.

Temporary Terminal and Battery Filler

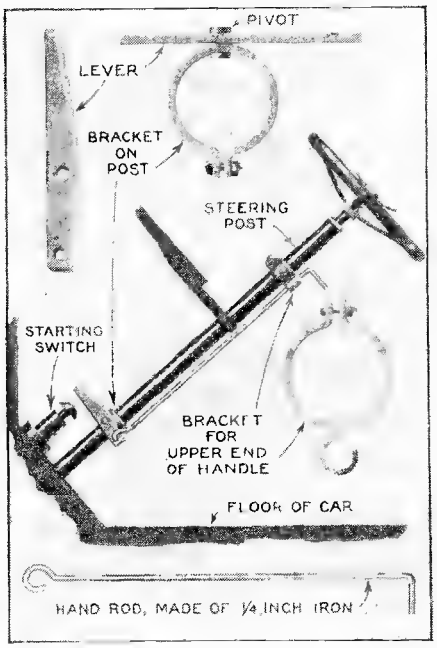


WHERE the terminal of a battery is corroded the tightening of the bolt may cause it to break. A strip of sheet copper is punched at both ends, bent to the shape shown and attached to the battery wire by a bolt, washer and nut. A bottle with a convenient vent will facilitate adding water to the battery. If the cork is nicked on one side, it will allow controlling the flow of water to the cells.


WOOD PIECE THROUGH HANDLE AND HELD AGAINST TIRE RACK
CROSS MEMBER
5/16 INCH IRON ROD BENT
HOLES DRILLED INTO EDGE OF SEAT
HOOKS
RUBBER SLEEVE
TOP VIEW OF CAR SHOWING METHOD OF FASTENING AWNING WITH HOOKS & ROPES

The Starter Control on Steering Post

MANY new models of cars are being equipped with starting button controls on the dash or the steering post. The advantage is leaving the foot free for operating the brake or accelerator while starting the engine after stalling



in some awkward position. A good steering post control for starting is pictured. This consists of a lever, two small brackets around the steering post and one rod. The lever is a simple straight iron bar, one end to rest against the starting button and the other drilled for the hand rod. Sheet iron forms the brackets, fastened by small bolts. A quarter inch iron rod reaches from the lever to a convenient place under the wheel. A pull on this handle and the engine starts, both feet being free to control the car.

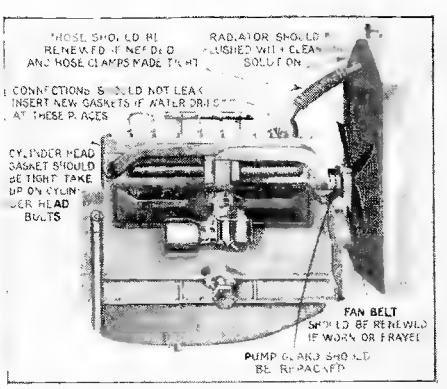
A Top for the Rumble Seat

THE rumble seat is one of the most undesirable locations from the passenger standpoint, particularly in rainy weather.

The top shown consists of a metal bow which slips into holes in the seat-back. Extending forward from this is a single section of pantasote. The turning type or snap-on fasteners are the means for attaching the forward edge to the car top. The rear edge is fastened around the rod. If desired, two metal rods can be added at the sides of the top, the top fabric being stitched over to provide an opening for these.

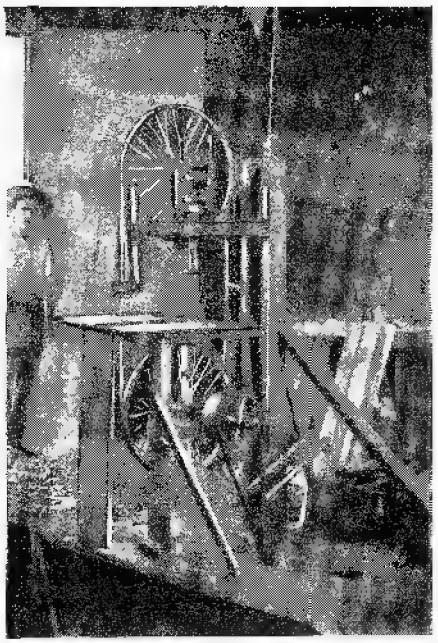
Cooling of Engine

CLEANING the radiator is an important detail. If grease or oil gets in the deposits fill the openings through the radiator and prevent water flow. A good solution to clean out the scale is lye. One-quarter pound is dissolved in three gallons of water, strained through a cloth and placed in the radiator. The engine is run until thoroughly hot and the solution is drawn off through the lower petcock. The radiator should then be thoroughly flushed out with clear water.


HOSE SHOULD BE RENEWED IF NEEDED AND HOSE CLAMPS MADE TIGHT
RADIATOR SHOULD BE FLUSHED WITH CLEAN SOLUTION
CONNECTIONS SHOULD NOT LEAK INSERT NEW GASKETS IF WATER DRIPS AT THESE PLACES
CYLINDER HEAD GASKET SHOULD BE TIGHT TAKE UP ON CYLINDER HEAD BOLTS
FAN BELT SHOULD BE RENEWED IF WORN OR FRAYED
PUMP GLAND SHOULD BE REPACKED

How They Make It in Costa Rica

By Russell Raymond Voorhees
Correspondent-on-the-Move



This bandsaw in a woodworking shop, San José, runs on a pair of discarded bicycle wheels with leather lined rims.

COSTA RICA is one of those small republics struggling with an overabundance of politicians which might escape notice if it were not for the fact that the people are adept in making useful things from waste and salvage.

The gasoline used in Costa Rica is imported in five-gallon cans. The average person would think that after the gasoline had been emptied the only thing to do with the empty can would be to feed it to the goats, but the ingenious Costa Ricans will not have it so.

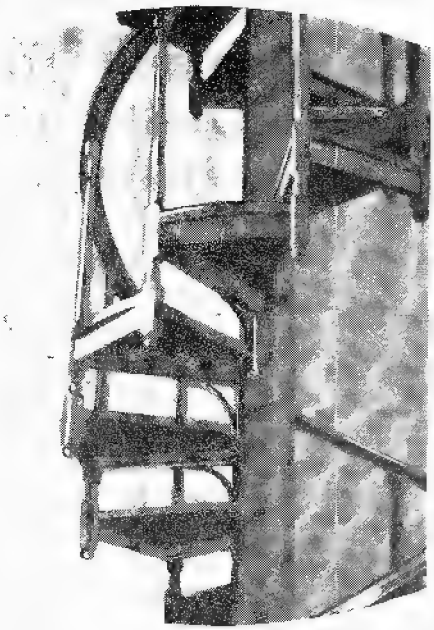
Of the many things that are made from gasoline cans, perhaps the most useful is a miniature stove which does excellent duty in many, many homes, especially in the homes of the smaller and poorer families, of which there is an overabundance.

To make one of these stoves the first step is to close and solder two holes which are always punched in the top of the can in order to pour out the gasoline. Next a rectangular piece, a little narrower than the original height of the can and exactly as deep as the can is wide, is cut out of one side. A smaller rectangular piece is cut out of the adjoining side and a half-circular piece just above it.

With the large rectangular cut removed uppermost, the upper portion of the can is lined with a clay mixture. A collar is soldered around the edge of the cut. The lining is brought above this collar and leveled off to form a flat surface on which to rest pots and pans in the process of cooking.

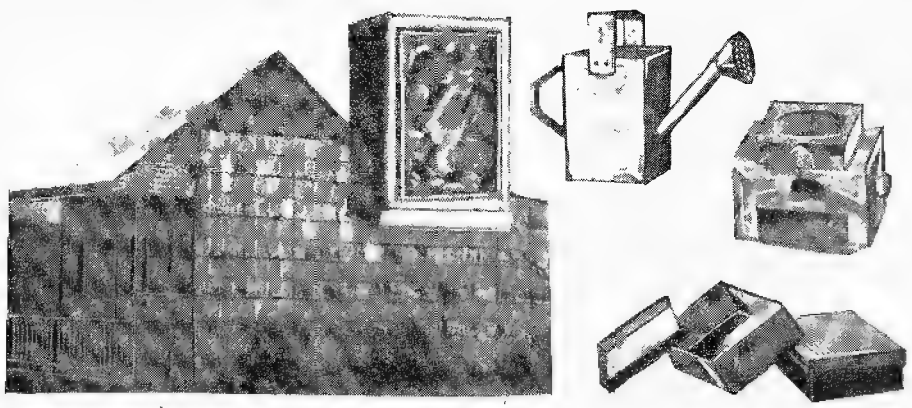
The clay lining divides the inside of the can into two horizontal parts, the upper one being the firebox in which is burned charcoal and the lower one the baking oven. A tin door is added, with two pivoted pieces of tin to hold it. These stoves sell at retail for two colones or pesos, Costa Rican money, which is exactly fifty cents in the U. S. A.

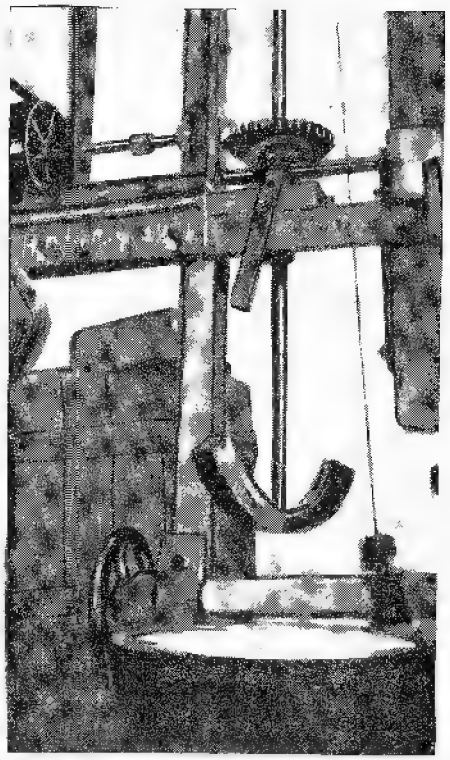
There are literally dozens of other articles and uses for the lowly gasoline can. For instance the cans are flattened out and used for the covering of sides of little shacks in place of sheet tin. (*Continued on page* 659)



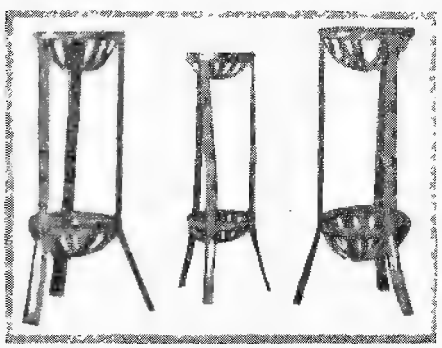
Ordinary kitchen-shelf brackets form the supports for this stair in Cartago.

POLITICS-POOR — that's Costa Rica; but Costa Rica's Common People Have Developed in Their Poverty a Wonderful Talent for Making Useful Things Out of Salvage and Waste. . . . The Globe-Trotting Scribe, R. R. Voorhees, Tells You the Details Here in an Article Genuinely Unique





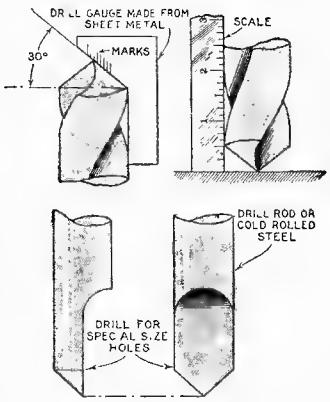
A pinion and gear from a junked Model T Ford transfer motion from shaft to shaft in this candy agitator at Alejuela.



Above—Flower stands made of metal binding taken from packing boxes. Left—Wall coverings, cookie display boxes, sprinkling cans, stoves, and candy boxes are some of the things Costa Ricans make from emptied gasoline cans.

Suggestions for the Home Machinist

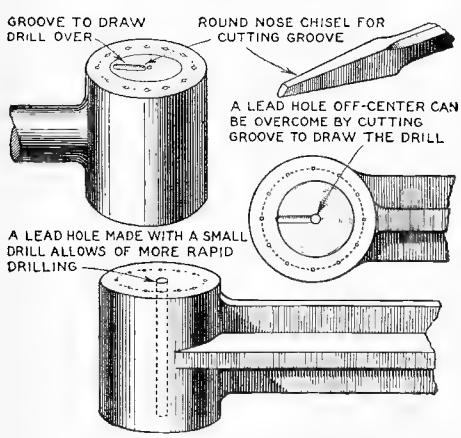
By George A. Luers



The Drill Point and the Special Drill Size

WHEN drilling a hole the point of the drill should be accurately ground (both cutting lips should be of equal length), otherwise the hole may be oversize. A simple sheet metal gauge as shown is a good guide to use in grinding a drill. A machinists' scale can be used to roughly check up on the drill point. It is placed to the side of the drill to measure the cutting face.

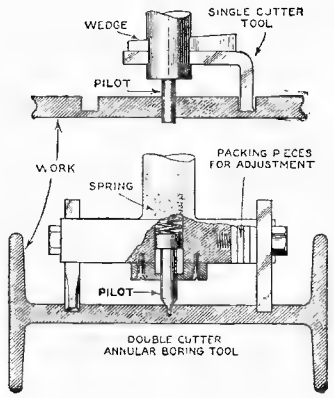
The drills shown in the lower view will prove very accurate for drilling special sizes of holes. A piece of drill-rod or cold rolled steel, the size of the hole required, is ground down, the end pointed, and the tool is tempered.


GROOVE TO DRAW DRILL OVER
ROUND NOSE CHISEL FOR CUTTING GROOVE
A LEAD HOLE OFF-CENTER CAN BE OVERCOME BY CUTTING GROOVE TO DRAW THE DRILL
A LEAD HOLE MADE WITH A SMALL DRILL ALLOWS OF MORE RAPID DRILLING

Centering the Drilled Hole

THE majority of jobs require drilled holes to be accurately positioned and the work is laid off with a scribed line and prick punch marks to indicate the hole position. When the drill is started and the point cuts off center of the scribed hole, it is possible to draw the drill over by means of a round nose chisel as shown. The chisel is used to nick out metal or make a groove in the direction it is desired to throw the drill.

If a small lead hole is drilled through the work, prior to using the large finishing drill, the hole may be cut more rapidly and with less effort. If the hole is drilled slightly off-center, the larger drill can be drawn back to the desired position, as shown by the upper view.

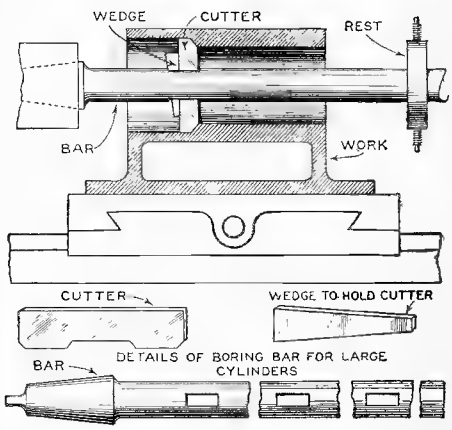


Annular Cutting Tools for Plates and Girders

HERE are two annular cutters for plate and girder work. The upper, a single cutter tool, consists of a bar with a pilot, a cutter and a wedge to hold the cutter. The pilot hole for the tool is first drilled into the plate. A more elaborate tool for cutting without a pilot hole, and having two cutters for rapid work, is the lower one. The pilot point is spring-held against the work. The cutters are made adjustable by wedges driven above the cutters through the slot.

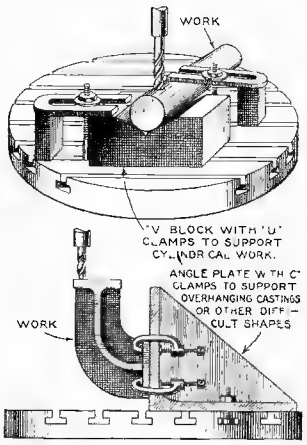
Simple Boring Bar for Large Boring Work

A JOB that frequently has to be undertaken is the boring out of large diameter holes, such as the cylinder of a pump casting. If a single fly cutter is used the hole is apt to be smaller at the center of the casting, due to spring of the boring bar. The best and quickest method to bore out such a job and obtain a bore of uniform size is shown below. A boring bar is selected, one having a diameter as large as possible. A cutter is made from flat tool steel, grinding this cutter so that both ends are of equal length measured from the central notch. A wedge is used to hold the cutter in the slot in the boring bar.



The cutter removes metal at directly opposite sides of the work and this tends to prevent spring or deflection in the bar.

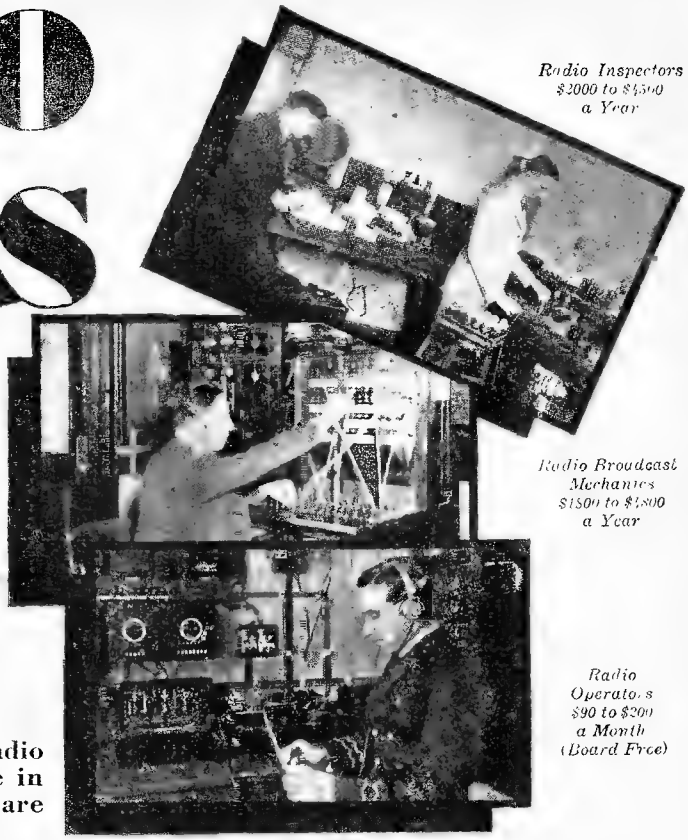
Vee Blocks and Angle Plates


WORK
"V" BLOCK WITH "U" CLAMPS TO SUPPORT CYLINDRICAL WORK.
ANGLE PLATE WITH C CLAMPS TO SUPPORT OVERHANGING CASTINGS OR OTHER DIFFICULT SHAPES
WORK

WAYS to hold circular work and work where no supporting face is directly under the area to be machined are illustrated. The upper view of this figure shows the general method of using the "V" block. All circular jobs can be supported by adequate clamps and blocks, arranged either on the machine bed or on an angle plate. In the lower view is shown a piece of work supported by clamping to an angle plate. Usually C clamps are the means used to secure the casting to the plate, blocking out if required to line up the face to be drilled or bored. The angle plate should always be secured to the machine bed.

This Page of Ideas for the Home Machinist Is a Regular Feature of SCIENCE AND INVENTION . . . Its Author Is a Consulting Engineer by Profession, and Is Supervisor of Ordnance Design at the Naval Gun Factory, Washington, D. C.

RADIO NEEDS YOU!



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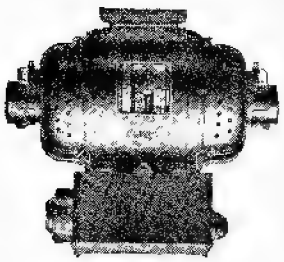
What's New in Radio

Dynamotors and Motor-Generators for A.C. Receivers

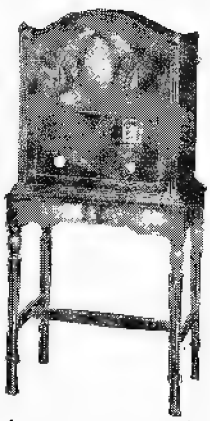
THE Electric Specialty Company, announces a new line of dynamotors and motor-generators, for operating alternating current radio receivers, or other apparatus, from direct current. They are equipped with standard attachment plugs—providing "plug-in" connection between alternating current apparatus and direct current. A new type filter is provided which in addition to silencing the noises of the machines, smooths out stray noises brought in by the direct current lines. This gives quieter operation than from the alternating current lines. All units have been



made as trouble proof as possible. They are equipped with wool pack bearings, which are long lived, quiet in operation and require a minimum of attention.

Semi-enclosing prevents damage from objects getting into the machines, yet permits ventilation, assuring cool operation. Dynamic balance eliminates vibration. (This is very important in the high speed machines.) Totally enclosed wiring improves appearances and safety. The new line of machines and filters are made in both high and low speed.

Superheterodyne



GRIGSBY-GRUNOW Company announces the Majestic model 52, a screen grid superheterodyne. It is designed in a greatly reduced high-boy type, measuring 39¼" high, 18½" wide and but 12¾" deep.

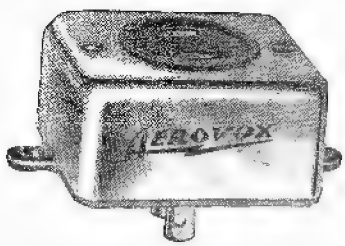
The superheterodyne circuit employed consists of a stage of radio frequency amplification, an oscillator, a first detector, an intermediate frequency stage, a second detector and a push-pull output stage. The speaker, volume and voltage controls are all an integral part of the chassis.

Interference Filter

A NEW type interference filter has recently been announced by the Aerovox Wireless Company.

In this interference filter, a plug receptacle is provided on one face of the unit and plug prongs are provided in the opposite face. The prongs plug into any standard wall socket while the plug of the receiver or appliance can be plugged into the receptacle of the interference filter.

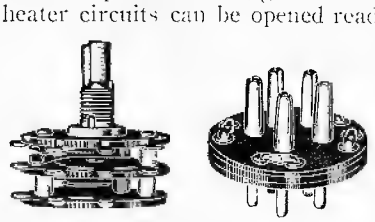
The outlet type illustrated here is unique. It comprises a square plate designed to fit just over the mounting holes of the outlet wall plate so that the screw which fastens the wall plate to the outlet box can be used to fasten



the interference filter and outlet plate to the outlet box, thus providing an efficient and convenient ground connection for the filter, instead of requiring the unsightly ground wire connection necessary with most interference filters.

Adaptor and Trouble Finder and Switches

BEST Manufacturing Company is manufacturing an adaptor and trouble finder and three types of selector switches. The former is specially adapted to making all circuit connections to a five prong tube base where no wires are exposed. Plate, grid, cathode, or heater circuits can be opened readily



for connection of meter or test equipment. This device may be used for connecting phonograph pickups or meters to radio sets or amplifiers.

In the line of selector switches, knobs are keyed to shafts to prevent their slipping. All contact members are of spring phosphor bronze. Model W-23, which is illustrated here, is a doublepole, 4 point switch.

Jackson-Bell Midget

AN outstanding feature of the new model "62" Jackson-Bell Midget which has just been placed on the market by that company, is its tone control. This receiver contains six tubes, four type -22 screen grid, 1 type -24 power tube and one type -80 rectifying tube. It has three stages of tuned radio frequency amplification with four tuned circuits and screen grid power detector. It contains only one stage of audio frequency amplification, which is resistance-coupled to the detector.

The radio frequency circuit is known as a "constant gain" circuit, in which the amplification and selectivity over the entire broadcast band remain practically constant. The selectivity of this receiver is not appreciably affected by the length of antenna used.

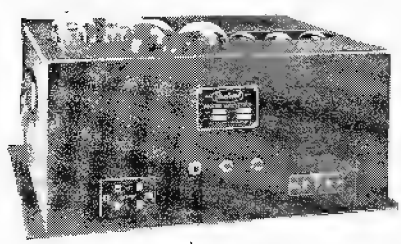
Tuning is controlled by a single illuminated dial operating a four-gang condenser. Volume control and switch are combined in one unit.

The speaker is electro-dynamic, designed by Jackson-Bell engineers for this receiver.

Power supply is protected by a two ampere fuse. This is arranged so that it may be inserted in one of two positions—one for 110-volt lines, and one for 125-volts. An electrostatic shield is provided between the primary and the various secondaries of the power transformer for the purpose of suppressing the antenna effect of the a.c. line. This is an important factor in the performance of the receiver, and has a great effect upon the selectivity of the set and the ability to obtain zero volume on strong local signals.

Amplifiers

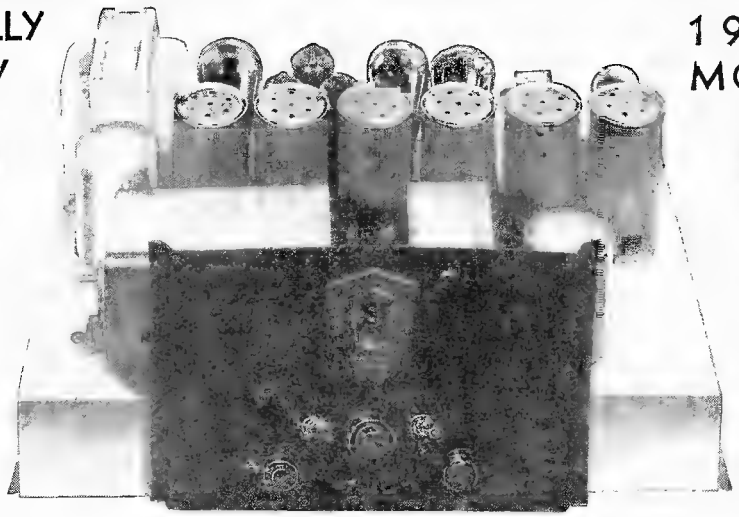
A COMPLETE line of power amplifiers for public address and centralized radio systems, is announced by the Rauland Corporation. In addition to portable form and also panel types for mounting on channel racks, the line includes portable and panel mixers, preamplifiers, and microphone current supply units and other equipment for complete sound system installation.



The portable power amplifier illustrated here, is contained in a strong metal cabinet with carrying handles. It has an eight foot heavy rubber cord and rubber jacketed plug. There are two types—fixed output impedance and variable output impedance.

WHOLLY NEW

1931 MODEL



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PATENT ADVICE

CONDUCTED BY JOSEPH H. KRAUS

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain patent phases. Regular inquiries addressed to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail, a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE: Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

Flashlight and Vanity-Case Combination

(1236) Mr. E. Schultz of Buffalo, New York, asked whether we know of an article marketed or patented that consists of a combination Vanity Case or Compact and Flashlight, so constructed that when the case is snapped open the light shines on the user's face, enabling her to use the device in the dark, as in a theatre.

A. We have seen devices of this nature on the market, but have not seen any during recent years. It is conceivable that the item if correctly designed and appealingly presented might meet with favor. The venture strikes us as being dependent entirely upon your ability in properly playing up the suggestion.

In view of the fact that the product seems to have been taken off the market, or is rarely seen, it is doubtful that it met with popular appeal. Your own idea along this line might find the similar difficulty.

We advise extreme caution.

Double-Pointed Phonograph Needle

(1237) Gaith Ficker, Asheville, N. C., asked whether we believe he could secure a patent on the design of a double-ended phonograph needle.

We are extremely doubtful if you could patent this suggestion. The idea does not present an article of marketable value and the extra saving in steel is of little consequence, when one considers the difficulties attendant on the manufacture of such a needle or the generally inferior results which it would give.

We would not advise further procedure.

Electromagnetic Brake for Automobiles

(1238) Jerry C. Clark of Oolitic, Indiana, asked whether we would suggest that he apply for patent on an electromagnetic brake for automobiles using the principle of an ordinary disk clutch operable by the electromagnet and a connecting lever.

A. Some five or six years ago at the Inventors' Show in New York an electromagnetic brake was demonstrated. Up to the present time this brake has not been applied to any of the commercial automobiles. We do not believe that any electromagnetic brake can compare with the modern four-wheel brake, nor do we believe that an idea along this line is of any value whatever unless you are in a position to sell it to some manufacturing organization. A patent could undoubtedly be taken out on this item. Your construction seems to indicate enough differences to enable it to be fully protected by patent claims.

Portable Folding Porch Swing

(1239) A. M. Shandor, Lilly, Pa., asked whether we would suggest that he apply for a patent on a portable folding porch swing.

A. Your question does not give us enough information upon which we can base an argument for further procedure.

We shall be glad to comment upon this suggestion if you will furnish the necessary details.

A Moon Plane

(1240) Phil Margulis of the Bronx, New York, has designed an airplane which is not based on the rocket principle, but with which he expects to attain tremendous altitudes. He merely adds a tank of oxygen.

We do not see how the airplane which you have designed can conceivably be made to rise to any greater altitude than those which are now attained by plane.

Every airplane that is made for the purpose of breaking an altitude record is provided with a super-charger which has a tendency to furnish a greater amount of oxygen to the engine. Your system will do nothing more. The idea is worthless and we do not consider it patentable.

Automatic Clock for Parking Lights

(1241) Jacob Schotel, Brooklyn, New York, has designed an automatic clock for turning on the parking lights of an automobile at a predetermined hour and shutting them off again. He asks our opinion.

A. The idea is undoubtedly good. Such a device could be used and could conveniently be placed on some of the modern cars. The question rests not with the idea but with the possibility of selling the idea after it has been patented. We believe that you have no chance whatsoever with a suggestion of this type and if any automobile manufacturers cared to duplicate the stunt they could do so with ease. We do not find that you have any basic ground for a patent claim.

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Registered Patent Attorney

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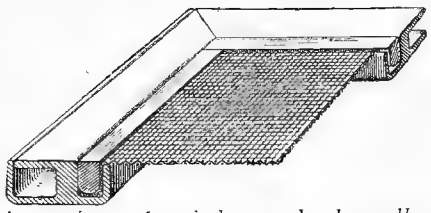
Frames for Metallic Screens

No. 1,772,780, issued to Louis J. Milone

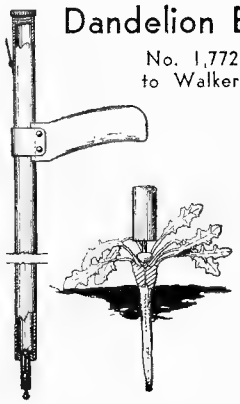
THIS invention relates to metallic screens for windows, doors, etc., and is an improvement on the patents issued to Arthur L. Otto. Practical production methods are described for the



formation of tubular and channelled rails and stiles of aluminum or other similar metal, the construction being light, economical and neat in finish. The screens themselves can be arranged to be a press fit into the channels of the frames, as shown in the accompanying diagram, or they can be a sliding fit in the vertical frames only, so as to roll up out of the way into a receptacle at the top when not required.

Dandelion Exterminator

No. 1,772,763, issued to Walker Van Riper

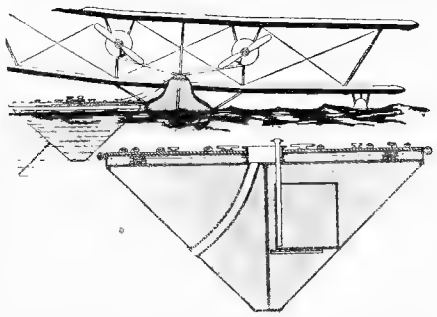


THE object of this invention is to provide a simple appliance adapted to discharge a noxious liquid onto the crown of a plant without affecting the soil around it. It is based on the knowledge that if gasoline or other similar destructive liquid is deposited on the head of a dandelion it will, in a short time, permeate the entire root. The device is simply a tubular reservoir with a spring loaded valve at the end. When this valve is pressed up on the crown of the dandelion the valve is opened and a quantity of gasoline is permitted to flow into the root.

Floating Station for Aircraft

No. 1,773,029, issued to Alan J. Cobham

THE object of this invention is not to provide Atlantic aerodromes but floating stations for mooring flying boats and seaplanes. The stations are designed to be anchored in sheltered waters where such aircraft may moor in safety while being refuelled and otherwise serviced. They are comparatively stationary, will not swing round with changes of the wind, and have no obstructions which will be likely to inconvenience any craft moored alongside. The stations consist of conical buoys, moored by means of an anchor cable

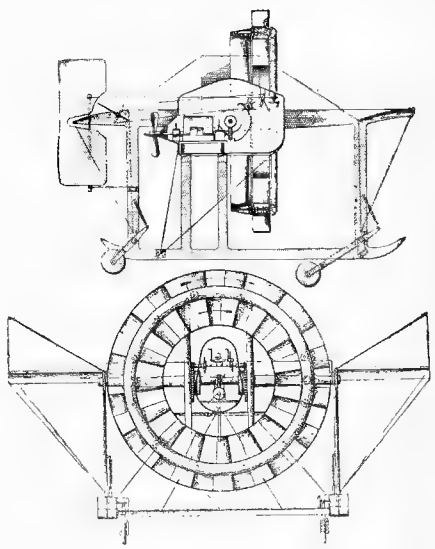


passing through a hawse pipe midway between the deck and the apex of the cone. The deck itself is turnable independently of the buoy itself, so that moored aircraft can swing with the wind without causing the entire station to swing. Fuel tanks are provided within the buoy.

Flying Machine

No. 1,772,049, issued to Simon Lake

THIS invention relates to a flying machine of the heavier-than-air type which is so designed that the propelling forces can be directed to drive



the machine in any desired direction ranging from the horizontal to the vertical. It is possible by means of it to take off either horizontally, after the manner of existing airplanes, vertically after the fashion of a helicopter, or at any intermediate angle. Flight may also be maintained at any angle irrespective

of the position of the usual controlling surfaces. This is achieved by the use of two plane rings, mounted concentrically, which are driven through gearing in such a way that they revolve in opposite directions, as indicated in the lower cut above. The revolving planes are mounted in gimbals so that they can be inclined at an angle at the will of the pilot. The engine and a pusher propeller are mounted in the cab or cockpit.

Make Your Own Castings

(*Continued from page 628*)

vide a hold or shelf for the sand so that when the two halves are separated the sand will not slide out of the "flask" sections.

Tapered dowels or cleats fastened to the sides of the "flask" sections must be carefully made so that the two halves fit accurately together. Care should be exercised in building the "flask" to assure a rigid form, with sections that accurately match. The construction of such a "flask" is shown in Fig. 2. The cover, called the "moulding-board" is a duplicate of the flat section used as the "bottom board." These boards, of one inch stock, should measure about 13″×9″, and both are best provided with 1″×2″ cleats to strengthen them and make it easier to pick up the "flask" from the floor.

The moulding sand should first be screened to remove the lumps, then it should be carefully moistened, sifted and shovelled about so that the moisture is evenly distributed. If, when compressed between the fingers, the sand forms into a cake and shows all the finger marks it has sufficient moisture and is ready for use. If it fails to cake or if it crumbles it is too dry and more water is required. A sprinkling pot of small size will be found useful in bringing the sand to the proper working consistency, as it will spread the water and prevent uneven wetting.

The sand must be of the proper consistency, for if it is too dry it will crumble or being too wet it will "boil" when pouring in the molten metal through the formation of steam. In either event poor castings will result.

To make a mould the operation is as follows: The "drag" or lower section of the "flask" is placed on the "moulding-board" and the pattern, assumed to be a simple affair, such as a face plate for a drill press, is placed flat side down on the "moulding-board," off to one side rather than squarely in the center.

A quantity of sand is then sifted into the "drag" until it is filled level, as shown in Fig. 3. Then the sand is "rammed" down and smoothed off even with the top edges of the "drag," by using the "bottom-board" as a straight edge. The sand must be rammed properly, for if rammed too hard the surface of the sand next to the pattern will disclose cracks. If not rammed enough the sand will fall or run out of the "drag." Several trials should provide sufficient experience to determine how to pound in the sand.

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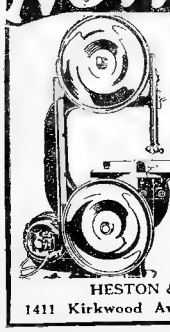

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When the pattern has been properly rammed in the "drag," put the "bottom-board" on top and then turn the "drag" other side up. The "moulding-board," now at the top, is removed and the upper half of the mould, the "cope," is placed in position, as depicted in Fig. 4. The surface of the sand held in the "drag" is dusted with coal dust by shaking the dust bag over the "flask." The dust which falls on the pattern is removed by blowing. The dust prevents the two sections of sand from adhering.

The "cope" is then filled with sand and rammed, and after leveling off, a wire about the size of a knitting needle is pushed down through the sand until it touches the pattern. A number of holes should be provided by means of the wire so that the steam and air may escape when the mould is being poured. Fig. 5 discloses the manner of providing the vents.

A pouring hole is required and this may be cut by means of a "sprue-cutter" made from a piece of ¾" iron pipe. If desired a tapered plug may be used to form the "sprue" or pouring hole. After forming the "sprue," place the "moulding-board" on top of the "cope" and then the "cope" is lifted from the "drag." This is the most critical stage of the operation, for if the "flask" is not properly made and sticks, or the sand not of correct texture, the mould may be destroyed by the sand falling out. With a little patience and practice the "flask" may be parted without difficulty and a clear mould obtained.

Cutting the "Gate"

With the two halves of the "flask" separated the next operation is to cut a "gate" in the sand, so that the molten metal may flow from the "sprue" to the form left by the pattern, after it is removed. An old spoon may be used for cutting the channel. When this is accomplished the next step is to remove the pattern from the sand. A sharp rod or "draw pin" is driven into the pattern, which is then tapped in all directions to loosen the sand slightly. It is a good plan to withdraw the pattern slowly, rapping it gently while doing it, so that any sand which has a tendency to adhere will loosen.

The "cope" is then placed back in position upon the "drag," the accurate centering of course depending upon the dowels or cleats. A heavy slab or brick is placed on top of the "flask" above the mould to prevent the pressure of molten metal from separating the sections or lifting the sand. The mould is then ready to pour. Fig. 6 shows the "flask" prepared for the molten metal.

The molten metal should be clean and sufficiently heated to pour well. It should be poured into the mould in a small steady stream, so that steam and air have chance to escape. The metal should not be poured directly into the center of the "sprue" for the metal will otherwise strike the bottom with enough force to loosen the sand, which would result in a dirty casting.

Sand that is too wet will emit a large volume of steam and will produce imperfect, porous castings.

Most castings are subject to a certain amount of shrinkage and where accuracy is required the pattern is made to provide for this reduction by making it of the proper oversize.

Shrinkage of Castings

Copper	3/16	inch	per	foot
Aluminum	¼	"	"	"
Brass	3/16	"	"	"
Cast Iron	⅛	"	"	"
Tin	1/16	"	"	"
Zinc	5/16	"	"	"
Lead	5/16	"	"	"

To obtain the weight of a casting, where white pine is used for a pattern, the following will be the approximate weights, where the pattern weighs one pound:

Aluminum	4.8
Iron	16.0
Lead	25.0
Copper	19.0
Brass	18.5

Where a non-shrinkage alloy is desired, which in turn may be used as patterns, the following formula should be employed:

Tin	58.5%
Zinc	22.0
Lead	12.5
Antimony	7.0

Other formulas are:

Magnalium:

Aluminum	85 to 95%
Magnesium	15 to 5%

Y Alloy:

Aluminum	93.%
Copper	4.
Nickel	2.
Magnesium	1.

Britannia Metal:

Tin	85.%
Antimony	10.
Copper	5.

Pewter:

Tin	90.%
Antimony	7.
Copper	3.

Low Melting Point Alloys

For the model maker it is best to cast the part in one of the low melting point alloys; then trim and fit the casting to the desired shape. If alterations are required the pattern can be worked over until the builder is certain that castings obtained from the foundry in brass or iron will be exactly suited to his requirements.

The experimental castings, either rejected as not being of the proper design or as being porous, may be melted down and the metal used over again.

Metals and alloys of the low melting point variety may be melted in an iron vessel, such as a clean iron or steel pot. The writer has used an enamelled sauce pan heated over an ordinary charcoal fire but either a gasoline torch or a Bunsen burner may be used.

Much ingenuity is sometimes required in making the patterns, so that they will leave the moulds without disturbing the sand.

Page Maggie Jiggs!

(*Continued from page* 594)

stand the sledge-hammer-like impact blows of the swinging pendulum; or, on the other hand, a specimen of ware may break readily under impact and yet be immune from chipping. This anomaly may partially be attributed to the design of the edge and the angle of inclination of the rim of the piece of ware.

While the findings of this official government breaker of dinnerware—the "mechanical man" delivering sledge-hammer blows—are consulted primarily by Uncle Sam for specifications in purchasing chinaware for the various government departments, they constitute a standard of quality for commercial manufacturers of dinnerware. At least 24 makers of domestic ware and four importers of foreign ware consult this swinging pendulum in its apparent rôle of destruction. The samples of foreign products undergoing these tests are made in England, France, Japan and Czecho-Slovakia.

These competitive tests—deadly parallels of comparison between "made-in-America" chinaware and that of other countries—are both an incentive and stimulating force to our manufacturers to better the dinnerware used by the approximately 122,000,000 persons in the United States. The delivery of blows by a swinging pendulum in a research laboratory in Washington means stronger dinnerware on the tables of Oshkosh and thousands of other places in this broad land.

Bringing Food

(*Continued from page* 594)

to the kitchen for refilling.

Electric heating elements beneath the conveyors maintain the heat where needed, while refrigeration is applied to other trays to keep ice cream, salads and other uncooked foods in perfect condition.

À la carte service may also be had and an absolute check may be kept by means of priced dishes. That is, the price of the order is permanently marked on the side of the dish under the glaze. On *à la carte* compartments a lock is provided on the trap door through which dishes are returned. The *à la carte* patron selects his food in the same manner as the flat-rate plan, but he cannot dispose of his dishes; an attendant takes care of adding the prices on the dishes and a check is handed the customer. This gives an opportunity for the purchaser of a light lunch as well as the full meal.

The restaurant is pleasing in appearance, simple, efficient, and noiseless in operation. Patrons are able to get all they want of what they want and when they want it without the assistance of attendants. The feature of being able to view and select the food desired as it passes before one creates an unusual appeal.

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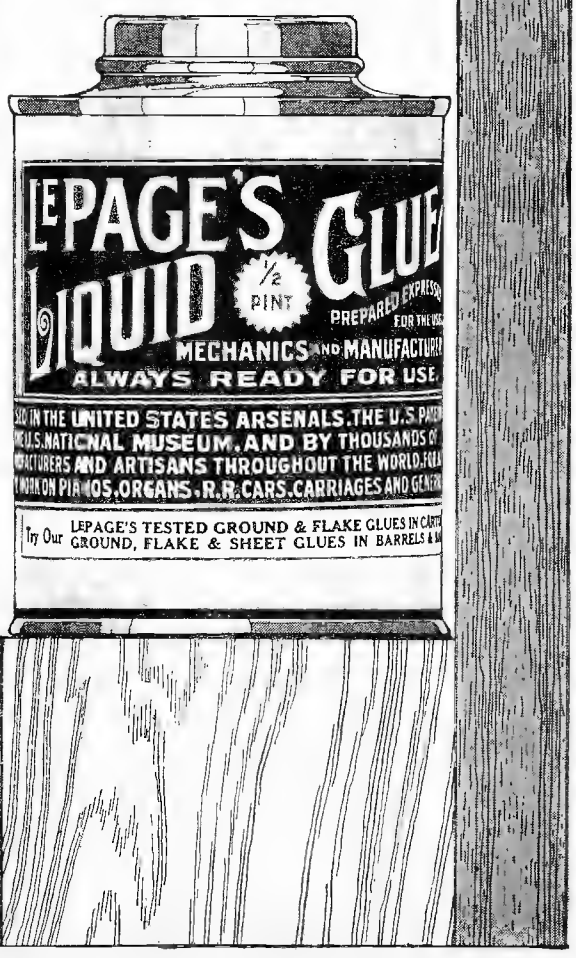
LePage's Tested Hard Glue—for those who prefer a hard glue and for joints that seem to require it. Tested for uniformity. No experimenting with each new lot to see how much water to add or how long to cook.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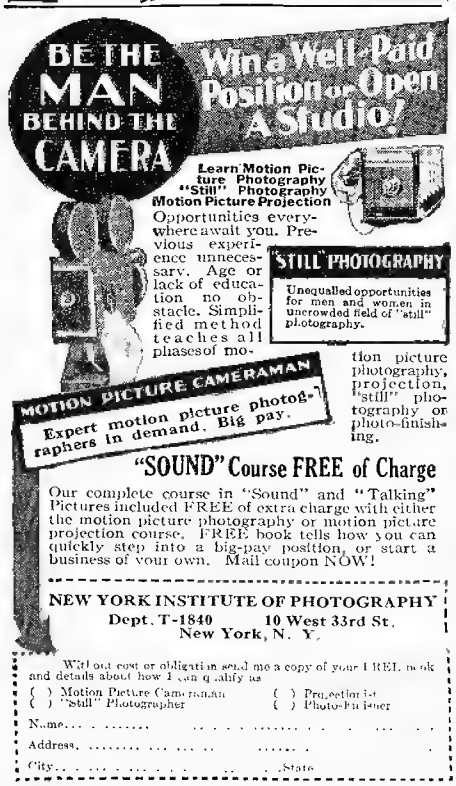
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New Lights on Old Masters

(*Continued from page 595*)

mannerisms of the masters of the Louvre. This colossal work is carried out by means of installations, optical, photographic and radiographic, ingeniously combined.

After having placed the picture on an easel, M. Cellerier or one of his assistants sits in front of the desk on which there are push buttons controlling the different apparatus. The operator then carries out the experiments necessary to establishing scientifically the character of the painting. As we have noted above, he determines the characteristics of the internal substance of the picture, as well as the more delicate characteristics of the individual technique of each painter. This varies sometimes in the work of the same master, according to the period in which it was painted.

It will be seen from the preceding observations, that the scientific expert investigation carried out as described will give very precise clues. But it will not be enough to depend on this alone in all cases. Science and criticism have to be combined to achieve certainty.

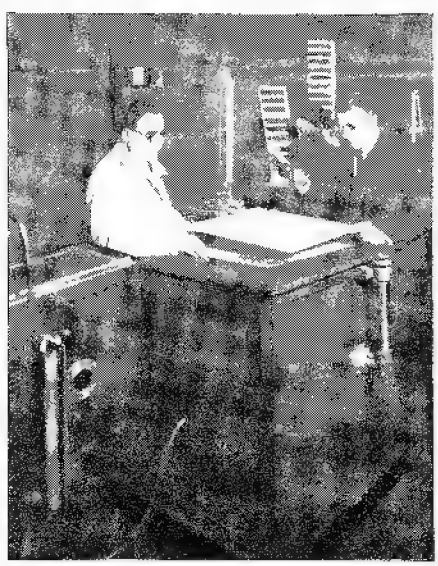
We can illustrate our subject by giving some typical examples, so as to show the importance of the investigations carried out by M. Cellerier.

We have for example a fresco by Cassariau, which used to decorate one of the rooms of the Ancienne Cour des Comptes in Paris, and which was injured in 1871 during the tragic days of the Commune. Wishing to preserve this important work, the directory of the

Photographing a picture with white light through a yellow filter.

Beaux-Arts had it restored as follows: After having stretched and secured a cloth over the surface of the picture, they scraped away the stone up to the mural painting. Then the latter was backed by a second cloth to support it. The first cloth was then taken away. In this way was obtained what is called in technical language the "marouflage," which means a picture more or less damaged by this double operation, on which a good painter can proceed with the necessary retouching. By photographing in the usual way the head of the principal personage of the picture thus restored, no trace of the work will be detected, while the surface changes and injuries will show very clearly with ultraviolet rays. The extent of the injuries is clearly seen because these last were repaired by the use of organic water colors, which permitted X-rays to pass through, while the old treatments on a mineral base were relatively opaque to the X-rays.

Let us consider now the monochrome reproduction of the celebrated "Benedicité" of Chardin, one of the jewels of the La Cozo collection in the Museum of the Louvre. Photographed by a proper screen in full light, this picture shows the mother and her two children, leaving the other details of the scene in obscurity. This exhibit shows the delicacy of the brush of the marvelous artist, while an X-ray of the portion of



Taking an X-ray photograph of an oil painting

the same picture showing the two children indicates the composition of the coloring materials which he used. These characteristics are found also in the other works of Chardin.

Let us now go on to the examination of a portrait of a woman of the Bruges School which is attributed to the second half of the sixteenth century. Photographing it with a white light and a yellow screen, M. Cellerier found nothing anomalous. Taking a second exposure with an electric arc light, whose white light contains a large proportion of violet rays, he found towards the left cheek and near the mouth a discord of tones. This observation induced the learned physicist to vary his optical experiments. He submitted the portrait next to ultraviolet rays giving it an exposure of forty-five minutes, when he observed the disappearance of cheeks, mouth and chin of the noble lady of

Bruges. In place of these facial areas there was visible a perceptible rough effect, undoubted proof of a considerable retouching. Going back to the original so as to get rid of the later touches, one can easily distinguish the indications of the inexperience of the retoucher. Eventually the X-ray photograph of the same work showed light retouching towards the base of the neck and the left cheek near the lid of the left eye.

On other ancient pictures the members of the laboratory of scientific research of the Museum of the Louvre have made various observations no less interesting. In the portrait of Isabelle of Bavaria, going back to 1435, ultra-violet rays disclose the delicacy of touch on the face. On the other hand, the headdress is treated more crudely; and yet the X-ray photograph of the picture shows no sign of retouching. The application of the colors of the headdress of the Queen of France seems to show a technique quite different from that of the face and bust. M. Cellerier concludes from this that the master painted the face, the bust, and the neck, leaving to one of his students the work of doing the hair of the too-famous wife of Charles VI.

Colored Filters

Again the examination with colored filters of a Madonna of the Umbrian School, painted towards the end of the 15th century, showed recent additions of pink colors on the cheeks of the faces of the Madonna, the Infant and the Angels. Apparently this retouching was done to restore colors deteriorated by time. The examination of this *chef-d'oeuvre* of the primitive Italians also shows a partial replacement of the old wooden panel as well as of the gilding and painting of this portion of the picture, thus restored because of an accident. In the Louvre Museum laboratory many paintings of the principal masters have already been examined by one or the other of the processes to which we have alluded above, and we understand that the Minister of the Beaux-Arts is to appoint a commission to develop new processes. Once in possession of sufficient material and of experienced collaborators, M. Cellerier will be able to bring together a collection of references worthy of the national artistic riches of France. The collection of these technical proofs will be of great service to public galleries, to collectors and to experts, enabling them to determine the authenticity of the pictures of the principal painters, to discover the retouching and repairs undergone by the same, and to unmask the counterfeiting, sometimes so perfect at first sight of the too-skillful forgers of yesterday and today.

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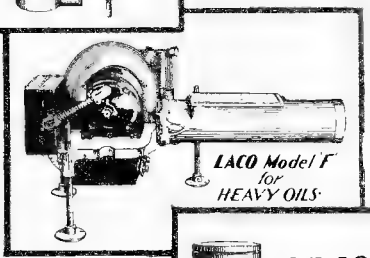

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Checking Up on Receiver Parts

(*Continued from page 621*)

lated by a single frequency tube modulator, operate from a common a.c. supply. The oscillators are shielded from each other, and all supply lines filtered, and they feed an r.f. transmission line which supplies the receiver with input energy. The oscillators show no great tendency to "lock in" together, when carefully tuned. Some precautions must be taken to prevent the natural 10,000 cycle beat notes from modulating any one of the oscillators, in addition to its own modulating supply. They are tuned to, say, 820-830-840 k.c., with modulating frequencies of 750, 1200, 1500 cycles. A switch is provided to cut off the "B" supply to both "outside" channel oscillators, simultaneously substituting a "bleeder" load of correct size on the power supply so that the output of the "center channel" will not increase. Attenuations are such that the center channel provides approximately 2 microvolts to the receiver, while the two outer channels each provide about 2000 microvolts. Many of the preliminary test adjustments on receivers may be made on the center channel, an output meter indicating sensitivity at this one frequency. The complete suppression of all signals from both outside channels then indicates normal rejectivity. It must, of course, be understood that such rejectivity alone means nothing; more complete checks by means of the usual signal generator, together with higher percentage modulation, serve to indicate that the shape of the overall characteristic is that for which the receiver was designed, that the fidelity is normal, etc., etc. It may be said in this connection that, in so far as the Hopkins intermediate amplifier is concerned, the peculiar manner in which the desired signal appears and disappears, as the small adjusting condenser is rotated, is, in itself, sufficient indication of the correct high pass and low pass characteristic of the respective stages. In general, it may be said that the construction of such a three channel oscillator has fully repaid its designers, and additional units are being constructed so that the same sort of observations may be secured at other points in the broadcast spectrum.

The results so far secured through the careful use of carefully designed parts test equipment has fully borne out our belief that "any means to an end are justified, if the results justify the means."

There were so many basement conversion plans received that really merited detailed consideration, that in order to get the best material for our final summary, we have decided to omit it from this issue (as originally planned), and publish it in our next (December) number. Look for it!

FORECAST

By the Official Forecaster

THE best contest ever staged! We think you will agree with us that this is the only adequate way to describe our new workshop tool and equipment contest. Or perhaps you overlooked the preliminary announcement in our October issue? If so, turn to page 597 of this issue and you will find a complete statement of the objects of this fine new contest, what to do, and how to do it. This is the finest opportunity ever offered for the ambitious young (or old, for that matter!) machinist or woodworker to **win a complete workshop outfit of his own selection.** Start in now. Consult your hardware dealer; we have already advised him of this contest, and he can help you. Write to the reputable manufacturers of tools and equipment for their catalogues. If you don't know of any, write to us, and we will do the rest. December 24 is the closing date, so let's all get together **now** and make this the **biggest, best** and **most successful** contest ever.

THE December issue of SCIENCE AND INVENTION is going to be a record breaker, packed full of interest from cover to cover. Here are just a few of the highlights. In the first place, we've got the dandiest cover drawing we've seen in a long time. You remember the Flettner Rotor ship which derives its motive force from the action of the wind on revolving towers? What more natural but that somebody should adapt the same system for airplanes, fitting rotors instead of wings. That's the cover drawing, in unusually striking colors, and the leading article in the issue describes the new plane.

YOU'VE all seen circus freaks, of course, and no doubt most of you have wondered what is the scientific explanation of these unnatural beings. Dr. Frederick Damrau will tell you in the December issue of SCIENCE AND INVENTION.

MR. A. DINSDALE, our new Managing Editor, and an authority on television, has a wonderful tale to tell of the tricks which the Heaviside layer plays with broadcast television images, and how the observed effects can be utilized to calculate the height of the layer.

AS a result of J. Phillips Dykes' series of articles on outboard motor boats we have been inundated with requests for constructional details and blueprints giving all the information necessary to build an outboard boat. It has been impossible for us to reply to all these requests individually, so we have done the next best thing, and our December issue will contain an article by Mr. Dykes which will give all the drawings, data, and instructions required for the building of an **exact duplicate** of the boat, built by himself, with which he has **won 29 out of 31 races.** Blueprints will be available, and further details concerning these will be announced in the article.

THOSE readers who are enthusiastic gardeners will soon be thinking about planting for next year, and in our next issue Dr. Bade will tell you what to do.

Experiments with Toy Motors

(*Continued from page 626*)

contact with lower strip H. Each strip has a binding post mounted on it. Two L screw hooks soldered together make a neat handle lever by which either strip can be depressed and held in that position, by a simple motion of the handle hook to the left or right. If the connections are made as shown in the diagram, then depressing either key strip will cause the motor to turn left or right.

A motor fitted upon a base with four binding posts as described readily lends itself to being operated in alternating current. It will be found that if the field winding or coil is connected in series with an electric lamp and the 110-volt alternating current circuit, that the lamp will light. If a radio rheostat is connected across the brushes or armature circuit, the motor will revolve, if the rheostat is regulated.

A paper or cardboard disc perforated with holes as illustrated in one of the photographs shows how one can make a wind siren. On whirling the disc with the motor and blowing through a rubber tube or soda straw through the rotating holes in one of the concentric perforations, a musical note can be heard. On allowing the air stream to strike another circle of perforations, a different note will be produced.

A miniature alternator can be made by mounting a circular iron (such as a galvanized iron) disc on the motor shaft. The circular disc should be cut at a point every quarter of an inch along the circumference, a quarter of an inch in toward the center. Each alternate segment thus formed should be bent toward the same side of the disc as shown in the photograph. By connecting a battery in series with an electromagnet and placing the magnet so that the pole is very near the revolving segments of the disc, a hum can be heard in the telephone receivers. This is due to the magnetic lines of force of the magnet being cut or altered by the revolving segments, the segments soaking up, as it were, some of the magnetic lines at a time when a segment is in close proximity to the pole of the electromagnet.

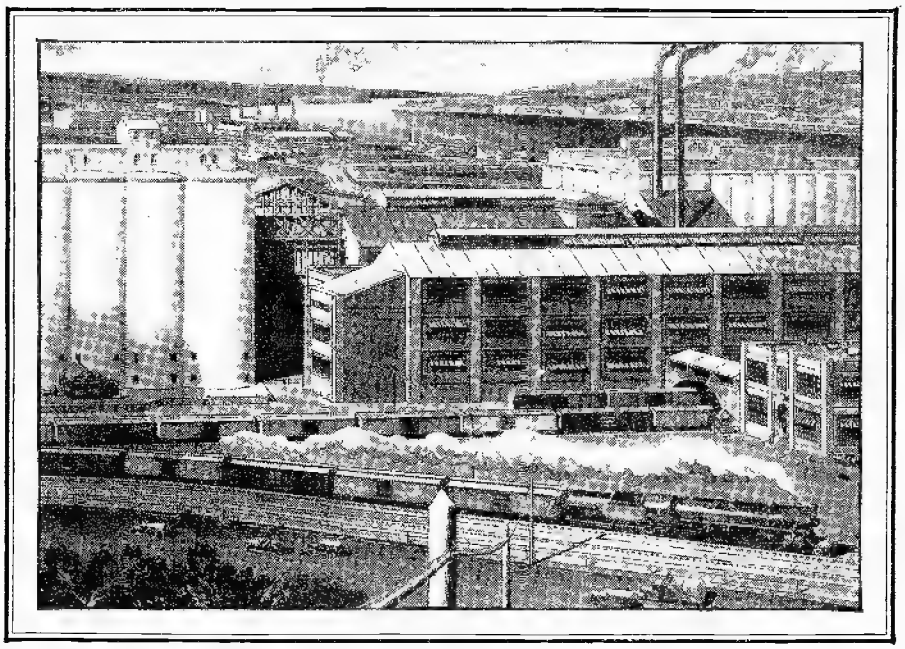
$5,000 FOR PERPETUAL MOTION

The editors have received thousands of different designs of perpetual motion devices, and have received hundreds of circular letters soliciting finances for the building of perpetual motion machines.

The editors know that if they receive these letters, there are thousands of others in this country who get similar letters and who fall for the claims made in the numerous prospectuses giving the earning capacities of the various machines.

Most of the shares of stock for these perpetual motion machines are being sold at a rate of $1.00 per share, although some inventors are trying to sell shares of stock at $100.00 per share.

Therefore, the editors of this publication say, "Just come in and show us—merely SHOW us—a working model of a perpetual motion machine and we will give you $5,000.00. But the machine must not be made to operate by tides, winds, waterpower, natural evaporation or humidity. It must be perpetual motion."



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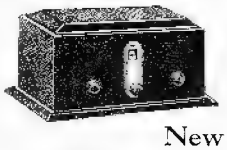

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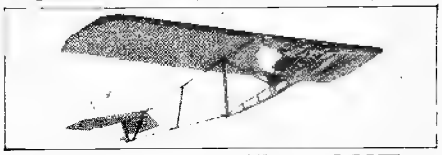

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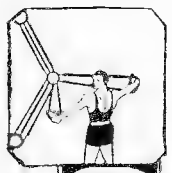

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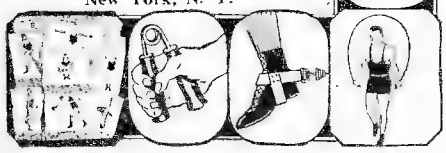

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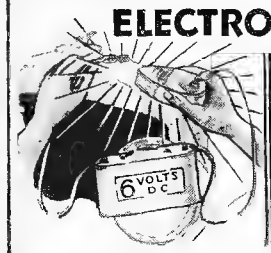

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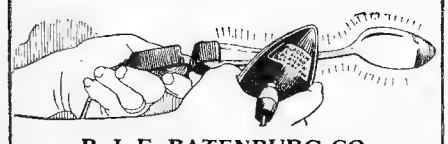

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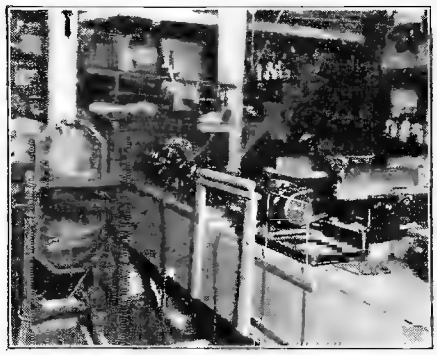
Prize-Winning Home Workshops

As Announced in Our October Issue, the First and Second Prize-Winners in Our Home Workshop Contest Were A. J. Stuhler, of Monticello, Iowa, and Richard Graves of Boise, Idaho. In What Follows We Give Brief Descriptions of Their Workshops



A corner of the smaller basement room part of Mr. Stuhler's workshop, showing the circular saw

IN describing his prize-winning home workshop, Mr. A. J. Stuhler writes: "My workshop is in two basement rooms of my home, most of the equipment being in the larger of the two rooms. The equipment itself consists of 1,238 individual tools and machines, each machine having its own individual motor. Altogether there are fourteen ¼ H.P., one 1/3 H.P., and one ½ H.P. motors.

"The general layout of the workshop is designed so that not only is the available space utilized to the utmost advantage, but also so that all machines can be conveniently operated.

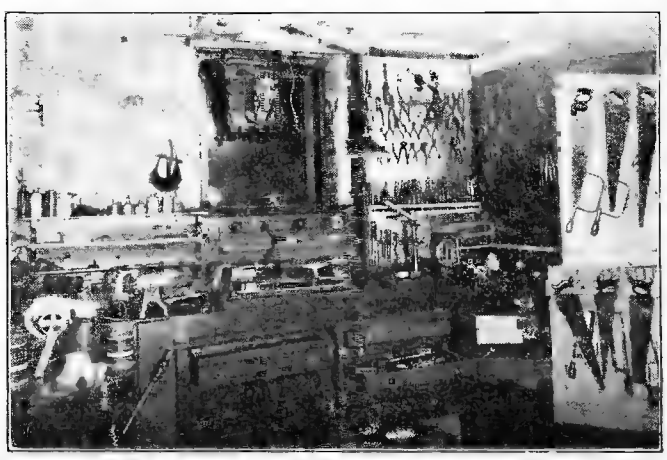
A view of the larger basement room of Mr. Stuhler's workshop

"As can be seen from the accompanying photographs, almost every kind of machine is included in the workshop. In addition to the woodworking tools there is also a fairly complete miniature chemical laboratory for experimental and electro-plating work. Welding and lead burning torches help to make up the equipment."

Richard Graves writes: "Many times in the past few years I have longed for an electrified home workshop, but have always had to cast aside the idea because I *thought* it would dig too deep into my bankroll. But when I got down to brass tacks and priced several of the articles needed, I had a pleasant surprise. Altogether my workshop cost me $13.00."

For that amount of money our second prize winner bought a 1/5 H.P. washing machine motor ($5), a polishing head ($2) on which can be placed the saw, emery wheel, drill chuck, buffing wheel, and a pulley to operate the lathe. The latter cost $4, is 30 inches long and has a 6½ inch swing. Accessories and et ceteras made up the bill to $13. Articles made by Mr. Graves himself include a sanding disc, saw-table, cross-cut guide and ripping guide.

Not the least interesting part of the descriptions of home workshops is the statements of cost. It is surprising to realize how much can be done with a small expenditure, provided the work of installation and purchase of parts is done by the owner in person.



Another interesting picture of the First Prize-winning home workshop, showing a lathe and a goodly array of well-arranged tools

Modern Suspension Bridges

(*Continued from page 590*)

investment?

In the new Hudson bridge there will be two decks, the upper of which will be in use before the lower one is completed. The upper deck will accommodate eight lines of vehicular traffic. The lower will accommodate four lines of rapid transit. Will future needs be greater than this? Possibly future suspension bridges more than two or three miles in length will have tubes placed on them, with cars driven through them at tremendous speed. The great stability of the suspension bridge makes this possible.

The tremendous amount of material used in the Hudson bridge is indicated by the fact that the wire used in the cables would reach a distance of 106,000 miles, equal to over four times the distance around the earth at the equator, or nearly half the distance to the moon. The total wire used in the seven next largest suspension bridges together would not be sufficient for the four cables of the Hudson River Bridge.

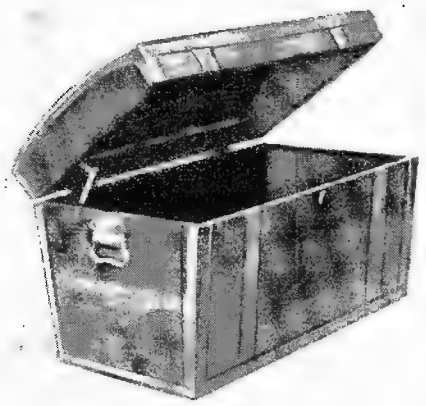
It takes about twenty minutes to climb the catwalk from the anchor to the top of the first tower and about one hour to walk across the main span catwalk. There are between 300 and 400 men at work on the bridge at all times.

Handy Chest Easy to Build

(*Continued from page 615*)

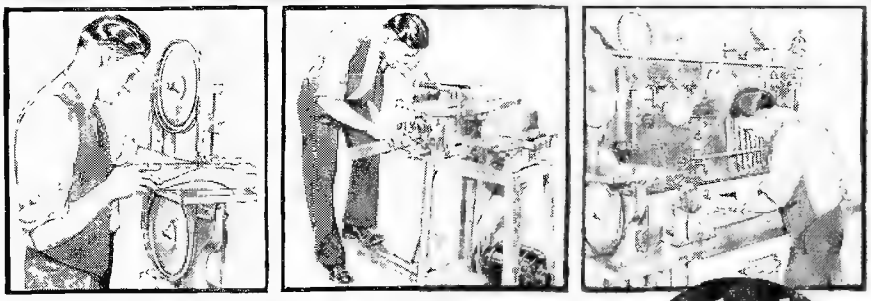
by hammering with a blunt tool over a soft board.

The skull and cross bones invite your artistic talents. Cut them from sheet copper as per the diagram, and give the skull a convex or embossed shape by means of a hammer and round-nosed punch on a piece of soft wood. The eye sockets and nose should be depressed and outlines of teeth, etc., made with a chisel or screwdriver. Shadows in the eye sockets and elsewhere are done in dark stains, preferably an ultramarine or dark greenish tint. A wide choice of handles will be offered by your hardware dealer. These should be well secured with small bolts, as screws may not stand a heavy load.



The finished chest

All Woodworkers Have Been Waiting for these Remarkable BOOKS



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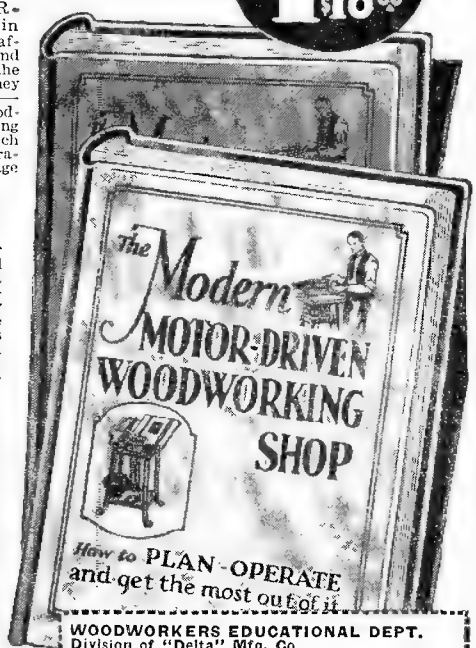

NOW that practical and efficient MOTOR-DRIVEN woodworking equipment is within the reach of all—no man who works with wood can afford to be without these two new books. The first and only books of their kind, they explain in great detail the proper methods of using motor-driven equipment. They tell how to plan a modern, motor-driven workshop—how to choose a Jointer, Band Saw, Circular Saw, Woodturning Lathe, Moulding Cutter, Boring and Routing Machine, Scroll Saw, and Sander—how to operate each machine efficiently—how to perform numerous operations on motor-driven machines of which the average person is not aware.

Hundreds of Photographs, Illustrations and Diagrams

Do you know how to make mouldings on the circular saw? Can you saw out Queen Anne legs on the band saw? Do you know how to adjust the knives of a jointer? How to use dado heads? How to resaw lumber? These and hundreds of other questions are fully answered in these two remarkable volumes. Also there are hundreds of actual photographs and drawings showing the proper method of operating motor-driven tools—close-up views that explain everything at a glance—diagrams and layouts of numerous motor-driven workshops.

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Some of the topics included in Volume 1 are: How to Lay Out an Efficient Workshop; How to Judge the Efficiency of Different Motor-driven Units; How to Operate a Jointer; How to Operate a Circular Saw; How to Do Grooving, Dadoing, Dovetailing, Jointing, Beveling, Notching, Rabbeting, Plain and Compound Mitering and Plowing.

Volume II includes: How to Operate a Woodworking Lathe; How to Do Spindle Turning, Face Plate Turning, Screw Center Turning, Beading, etc.; How to Operate a Band Saw; How to Use a Moulding Cutter; How to Use a Boring and Routing and Mortising Machine; How to Do Scroll Sawing, Sanding, Buffing, Grinding and Drilling on Motor-Driven Machines—and many other operations too numerous to mention.

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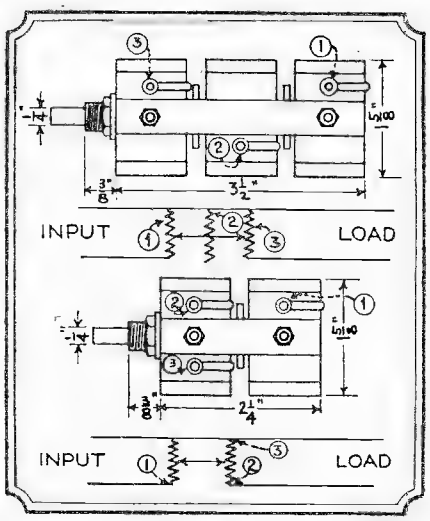
Constant Impedance Controls

IN controlling the volume of individual loud-speakers operating off an amplifier common to all of them, it is necessary to maintain the impedance of all circuits constant, so as not to introduce distortion due to unbalanced impedances or loads. For such purpose, constant impedance controls are necessary.

The accompanying diagram presents two simple clarostat constant impedance

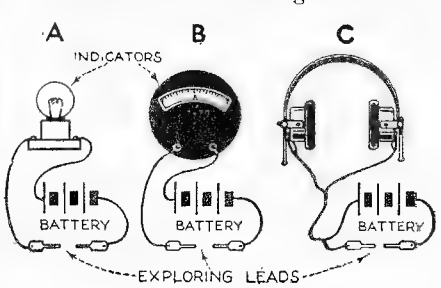


controls, one of the dual type and the other of the triple type. It will be noted that the resistance units are so arranged that as the single knob is turned, the multiple resistances are varied in such manner as to keep the impedance constant.

Test Apparatus

A SUGGESTION for the construction and use of three types of simple and inexpensive test apparatus for servicemen comes from John Bernard of Queens, Long Island, who writes:

"I experimented with the three types of simple testers shown in the diagram indicated at A, B and C. All three use a simple series circuit, the piece of apparatus under test being connected in series with the battery and some kind of indicating device. In the case of "A," it is a visual indicator as represented by the lamp. In "B" we also have a visual indicator, a deflection of the needle of the meter manifesting circuit con-



tinuity. In "C" we have the aural type of indicator where a pair of headphones is connected in series as the indicator of circuit continuity. Any will find ready use in the serviceman's laboratory and in the case of "A," a 50-watt lamp may be used with the regular 110-volt house current or a 6-volt automobile flashlight bulb may be used with the storage battery. The system represented at "B" makes use of a 50 or 100-volt voltmeter used in conjunction with one or two 45-volt B batteries. At "A" the circuit may be supplied by any dry battery from 4½ volts to 45 volts. By touching the terminal leads or posts of the piece of apparatus under test with the exploring leads of any one of these three systems, circuit continuity, and in the case of "B," circuit response may be roughly indicated."

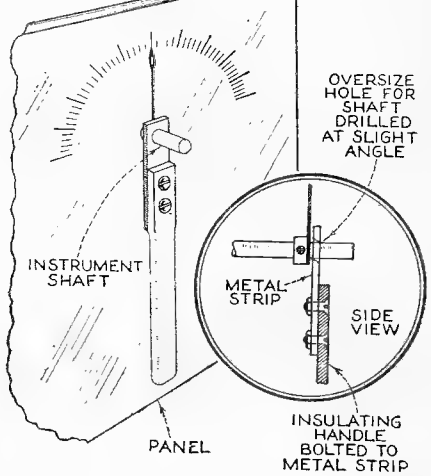
Vernier Dialing Device

WHILE there are many forms of vernier dialing devices in use, many times, especially in laboratory work, there is not sufficient space or convenience in operation to use them.

A practical device for this work is described as follows:

Take a flat strip of hard brass, drilled at an angle of 3 degrees or more, with a shaft hole of the required size, reaming slightly for loose fit, if necessary. This brass piece is then drilled for bolts to fasten same to an insulating handle of convenient length. Vernier ratio is proportional to the length of the device measured from the center of the shaft hole to the point of contact and pressure applied by the hand to rotate.

In using, no dial is used on the instrument shaft, but instead, a pointer is affixed thereto, which indicates position on an engraved or otherwise marked scale, on the panel (Paper scale of the protractor type may be used glued on panel). Vernier dialing device is placed on the shaft, light inward pressure exerted, causing device to grip shaft, then rotate to left or right. Precise adjusting is comparable with using large di-



ameter plain dial, with the advantage of much less space required, also when released device returns to vertical position again, regardless of shaft pointer position.

C. W. GALLINGER,
Ogdensburg, N. Y.

Sky Jobs

(*Continued from page* 593)

often move or change jobs before mastering their work. One factory prefers to draw its helpers from the most promising high school graduates nearby. The best aircraft mechanics must be able to use decimals, read blueprints, handle accurate tools and keep mistakes at a minimum.

Airport management offers an excellent future. Engineering firms are specializing in airport and hangar construction, keeping their engineering forces always busy. Floodlighting, site selection, grading and surfacing, radio and beacon installation, are among the problems to be solved. Experience as "grease monkey" and general handyman is always valuable to the future airport engineer and manager, who must find ways and means of making the airport pay its way.

The manager of an aviation employment bureau, the only one of its kind in this country, told me that metal workers, radio experts and licensed mechanics are being placed at the rate of around eighty a month. Only men with experience are listed, he said, largely between 18 and 30 years of age. He recommends that a young man select the line for which he seems most suitable, whether flying, mechanical engineering, stockroom clerking or what not, and then stick with it, getting as much training and experience as possible. He expects the industry to leap ahead after the next few months, as it did between 1927 and 1929.

Luminous Paint and Its Preparation

(*Continued from page* 616)

luminous paint. Wind-up tops of the "push the peg" variety can also have the phosphorescent paint applied to them to give a luminous effect in the dark.

Quite a novelty can be made by painting the salutation on valentine, greeting, birthday and other cards in luminous paint, adding in small script, "Look at me in the dark." Paper cut outs such as skulls, butterflies, table lamps, and other items all show up nicely when prepared with luminous paint. The constellations can be done in tiny paper stars made luminous with the paint. Quite a novelty would be a luminous dipper on the ceiling of the bedroom!

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Copy

Have you natural drawing ability? Copy Jack and let me see.

Copy me and get Ivorine Rule Free.—Jack

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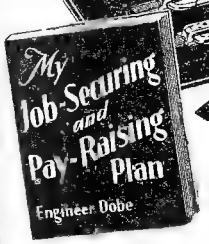

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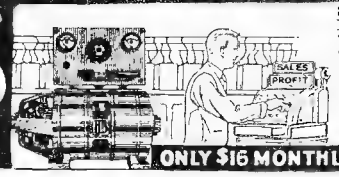

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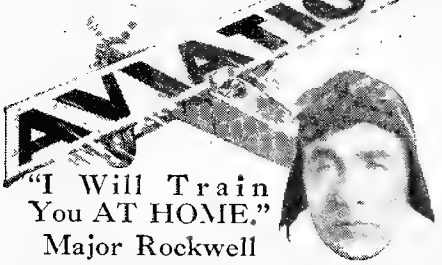

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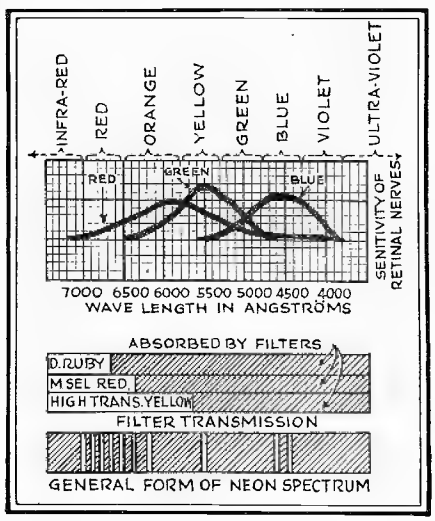
A Visual Attack on the Fog Problem

(Continued from page 613)

a practical method of "seeing" these long waves we may yet have aircraft beacons consisting simply of a tank of hot water!

In order to determine just what can be done visually with certain filters favoring the longer wavelengths such as red and yellow, the writer has been conducting some experiments during the past few months in many kinds of fog and haze, mostly along the Hudson River and in the adjacent mountains. The filters used in most of these experiments, particularly the photographic ones, were made up by the Corning Glass Company for the Department of Natural and Experimental Philosophy, U. S. Military Academy. We therefore use the Corning terminology for the various colors. For convenience of theoretical discussion we treat the various filters on a transmission or "penetration" basis. Actually, however, a filter cannot increase the intensity of the transmitted waves, though the eye pupil may approximate this effect by opening wider. *The filter's main action is to cut out the shorter waves which, because they come from the object by more crooked paths and from everywhere else to a certain extent by scattering and diffuse reflection, tend to make less clear in our eyes the image of the object.*



Diagrams illustrating the sensitivity of the human eye to various colors as compared with the various filters used in fog fighting.

The deepest red visible to the eye is given by "dark ruby," which cuts off all wavelengths shorter than about 6200 Ångströms and transmits only strictly red light. Theoretically, of course, this filter has the greatest advantage—about 2.3:1. That is, the mean of the filtered waves is 6600 and the mean of all visible waves is 5350, and the fourth power of their ratio is about 2.3. But when we try to look through fog with this filter we find that it cuts down the light very greatly—to about 1/20 of its former intensity—and the result is, unless the sun is shining brightly (as it practically never is in true fog) that this filter gives no aid to vision despite its theoretical superiority. But in sunlight haze this filter clears things up very strikingly, as the two photographs taken south (down the Hudson), from West Point well show. With the camera lens alone even nearby objects look monotonously gray, and visibility is very poor beyond half a mile. The dark ruby filter extends the visibility to about four miles; the southern hills at this distance are clearly outlined. In addition, the filter clears up all the skylines in the middle range, and greatly increases the contrast between light and dark objects. For an aviator flying down the river under these conditions, then, the filter should offer some advantages. For these photographs and the others as well, the camera was a 4×5 Graflex and the plates were Wratten and Wainright panchromatic.

The next filter on the scale is known as "medium selenium-red," though it actually passes both red and yellow in the spectrum. It cuts off at about 5900 Ångströms. Numerous experiments of ours in all sorts of weather have shown it to be the best all-around filter for visual use in ordinary daylight. It cuts down the total light to about one-fifth, but the pupil of the eye compensates in a few seconds by opening wider. The theoretical advantage is about 2.1:1. Of course no visual filter will enable one to see clearly through thick fog. The more nearly fog partakes of haze (the smaller the particles) the more effective are filters; the thicker it becomes, the less advantage they show. But in average fogs medium red glasses do seem to clear things up somewhat. There is better seeing of the penetrating rays, less interference from the scattered rays, an approach towards monochromatism or one color seeing, and better contrast between differently lighted objects such as a hillside and the sky. The two photographs, taken east across the Hudson River in a medium fog, show about what can be expected of this filter. With the plain lens the ridge on the left is very indistinct. The filter brings out this ridge line more clearly, as well as the main ridge; and it shows in addition just above the river a cliff that the plain lens misses entirely. These are small differences; but at the threshold of vision when a pilot can barely see ahead, this slight advantage might mean the difference between seeing a mountain and not seeing it, or it might permit a ship look-out to see another ship sooner by the small fraction of time that would mean safety instead of disaster.

In poor light or in artificial light at night both the red filters take out too much light to be of any use. We have tried the various filters while driving a car through thick fog at night. The red filters made it a game of blind man's buff, but a filter known as "high trans-

mission yellow" helped very slightly. This tint cuts off at about 5200 Ångströms passing the spectral colors red, yellow and green with a theoretical advantage of about 1.7:1. The filter is slightly more effective over the car headlights than over the eye; in both cases it tends to eliminate the back-glare of scattered white light. Some years ago there was a vogue of blue auto headlights; why, it is hard to say, for they must infallibly decrease fog visibility. It is true that blue shows some slight advantage in laboratory tests, but in actual field experiments this color proves inferior to white.

In a car, of course, the eye is behind the light source. In any case where the eye looks *with* the initial light rays, or along their direction of travel, selective scattering of the shorter wavelengths such as blue and violet is likely to cause back-glare. A red or yellow filter which cuts out these shorter wavelengths, at the eye or preferably at the source, always has advantages here. While the filter does nothing to increase the total light penetration (since it can add nothing to the intensity of the longer waves and may even diminish them slightly), it does help the over-all vision by removing some of the back-glare.

Against the Initial Light Rays

On the other hand; where the eye looks *against* the initial light rays, as in the case of an aviator looking directly at a beacon searchlight, conditions are quite different. Here no artificial filter is needed to cut out the shorter waves, because the fog will do it anyway. Thus auto lights or beacon lights seen at a distance through fog always have a yellowish or reddish tinge. Recently we have heard much of the neon beacon and its supposed fog-penetrating power. A year or two ago the *Leviathan* carried such a beacon, mounted high above the smoke stacks, on several trips across the Atlantic. Neon gives a bright line spectrum as shown in the diagram, having among others many lines in the red, one exceedingly bright line in the yellow, and two faint lines in the green. The precise spectrum will of course vary with chemical purity and the dispersion of the spectroscope. For beacon use there seems to be no good reason why such a light should be superior in fog penetration to one giving a continuous spectrum over the same wavelengths: for example, a tungsten searchlight equipped with a medium red filter. And, as the fog naturally filters out what fails to get through it, a powerful white light would seem to be as good as anything.

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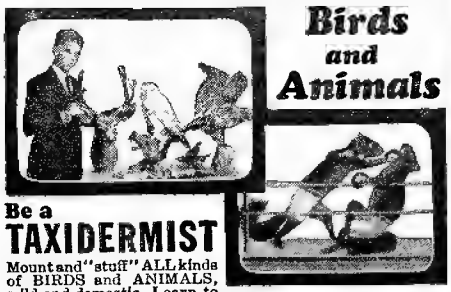

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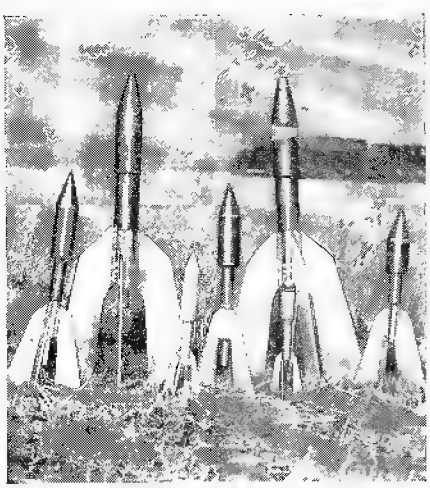
Will the Rocket Replace Artillery?

(*Continued from page 600*)

damage. In campaigns in 1807, 1808 and 1809, they were used on land and afloat at the siege of Copenhagen, in Lord Gambier's fight on the Basque Roads and in the Walcheren expedition.

So successful were they in competition with the undeveloped artillery of the day that Congreve predicted that in a few years rockets of an improved design would supersede cannon entirely. Unfortunately for this prediction, they were too costly and uncertain, as then constructed. Congreve's rockets used fuel not unlike that which propels ordinary modern skyrockets. They had a long stock to guide them as have the pyrotechnical pieces of today. The science of chemistry had not progressed to the stage where better explosive fuels could be adopted and little was understood about rocket trajectories and the mathematical calculations necessary to produce accurate aim. Too much fuel was required to carry the rocket itself into the enemy's lines; too little weight could be allotted to the "pay-load", the explosive or incendiary material that constituted the rocket's *raison d'être*.

Nevertheless, rockets constituted an important adjunct to artillery for the greater part of the nineteenth century. A field rocket brigade was formed in the British army in 1812 which joined the Allies before Leipsic in 1813, and contemporary accounts have it that the rockets fired on this occasion were markedly effective, causing great damage and inducing confusion and terror among the enemy.



Here is a representative group of Ludvik Ocenasek's rockets. Note the wide stabilizing fins. The remnants of which return to earth after the rockets explode.

The rocket brigade later distinguished itself in the battle of Waterloo, but already the use of rockets had begun to decline. Congreve's rocket was superseded by an improved, stickless type invented by Hale, but the development of artillery had already outstripped military pyrotechnics. With the invention of the rifled bore, of breech-loading, of independent recoil and of smokeless powder, the advantages claimed for war rockets were discounted in favor of artillery.

The new development of the rocket has come through the study of it as a means of propulsion. The pioneer work in this direction was done by Dr. Robert H. Goddard, of Clark University, who has been working at the problem since 1909 and is now, with the aid of generous funds, supplied by Daniel Guggenheim, preparing to build a rocket capable of soaring through the mantle of atmosphere surrounding the earth and sampling the conditions of outer space.

But the engineers and scientists of Europe have not been far behind him. Since the war a great impetus has been given to the study of rockets in Austria, France and Germany, principally as sources of power for automobiles, airplanes and rocket-cars intended to travel at great altitudes. The late Max Valier, who was killed while experimenting with a liquid-fuel rocket motor invented by himself, and Dr. Paul Heylandt in Germany are generally credited with having made an actual flight in a rocket-driven plane in secret tests. His development of liquid fuel for rocket-craft has been hailed as a revolutionary contribution.

Other Germans, including Dr. Hermann Oberth and Fritz von Opel, have also made great strides, perfecting fuels of much power as to make Congreve's two-mile rocket seem like the toy of a child. The most important development in connection with these new fuels is that such rockets are controllable. Unlike the dry powder in a common skyrocket, liquid fuels are subject to throttling, so that a rocket propelled by them can be speeded up, slowed down, guided or brought to a stop at the will of the operator.

No longer are these powerful rockets guided by a stick. In the simplest form they are equipped with large blades or vanes that direct them through the air in trajectories calculated in advance to compensate for distance and wind interference. Experiments have shown that swift, scientifically designed rockets of this sort can be landed accurately on a relatively small target at distances of a mile or more, restriction to deviations of fifty feet or less being possible. This accuracy approaches or surpasses that possible for artillery.

For long range bombardment metal-cased rockets using the multiple-rocket principle, in which two or three rockets are built together in such a way that as soon as one is burnt out another is set off, may be devised. Such rockets would travel at incredibly great speeds, describing a great arc more than fifty miles in altitude at its highest point and moving from Europe to America in less than two hours. Max Valier announced a short time before his death that he had already perfected plans for a rocket airplane that would be capable of a trip

from Berlin to New York in a little over 100 minutes traveling time.

What such an engine, turned to wartime uses by a hostile European nation, might do to the city of New York need hardly be described. It would not be difficult for a designer of modern rockets to provide for guidance by radio so that the presence of human pilots would be unnecessary. Loads of poison gas or explosives could be sent thousands of miles in such machines and released accurately in the heart of an enemy's city.

War rockets for general battle use may, in outward appearance, resemble those of Ludvik Ocenasek, of Vienna, who has been experimenting for several years on rockets designed to carry mail from city to city at incredible speeds. In recent months the Austrian government has moved to give him financial aid for the continuance of his experiments, perhaps, with an eye to their possible future use not only as carriers of mail but also as bearers of wholesale destruction in time of war.

With such rockets available the possibilities of these engines as military aids can hardly be overestimated. The army skyrockets of the future will not be loaded with colored stars and pretty sparks like Fourth of July pieces. They will be packed with chemical gases, liquid fire, shrapnel or smoke-producing chemicals. Perhaps they will be carried and fired by advancing infantrymen, who will be able to aim and discharge them without loss of time. Infantry will thus be enabled to provide its own barrage, eliminating the expense of artillery and avoiding the risk of walking into the falling shells of a friendly barrage inaccurately fired.

As Military Aids

Whatever the ultimate type or design, it appears likely that Congreve's early evaluation of rockets as military aids may be borne out. General staffs have become increasingly aware of the disadvantages of heavy artillery. Guns are too heavy and unwieldy. They are too easily damaged, too costly to furnish in large quantities, too weighty to transport swiftly and secretly, and wear out too quickly. Rockets need no cannon for firing. They can be started from the ground or placed in a simple, easily-constructed frame for proper aiming and elevating, and in the hands of trained men they can be fired with virtually the same general accuracy as the shells of a big gun.

Relatively less expensive than heavy artillery, great numbers of them can be used. It may well be that in future wars embattled troops, looking out of their trenches across the scarred contested territory, will behold the sky literally filled with barrage and counter-barrage of flaming rockets—innumerable screaming demons of fiery death, while residents of cities thousands of miles away from the battle zone will fearfully scan the heavens for the telltale comet tail of an approaching rocket-engine from the enemy, bearing gas or explosive to rain upon the defenseless citizens.

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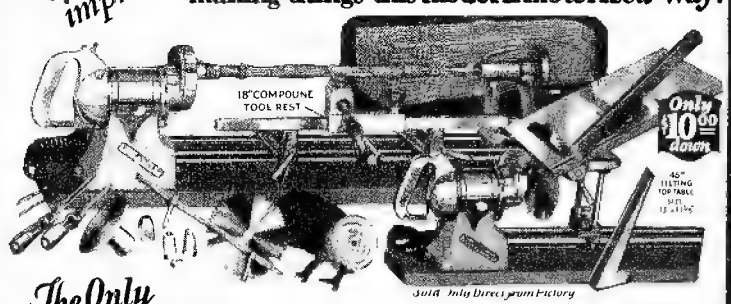

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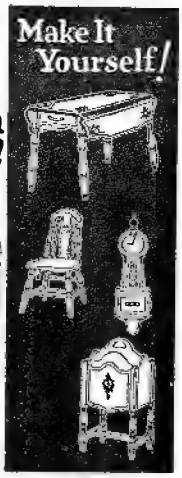

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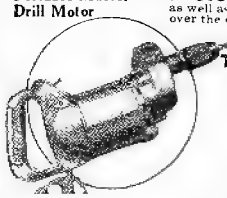

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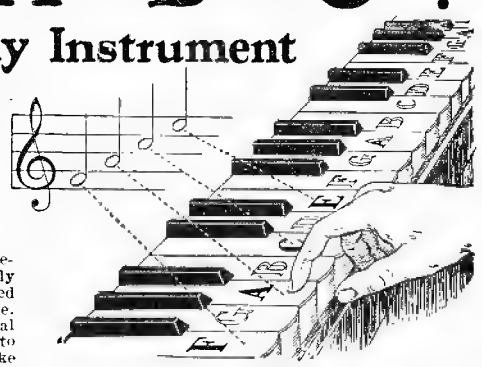

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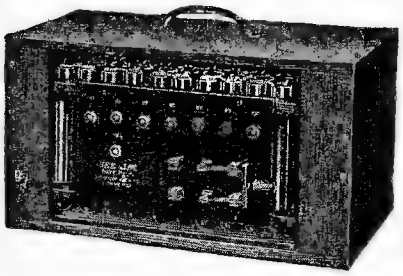

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(*Continued from page 623*)

turns. Turning the rod causes the piece O to move along it, thus moving H, G, and E. If the upper and lower linkages are identical, turning the wheel K will move the carbon holders E equally. The frame L is fastened to the block of iron D by the pieces of strap iron C, shown in Figure 1. D is drilled to take a ½ inch steel rod and is provided with a tightening screw.

The balancing resistance is shown in Figure 3. This shows the resistance made of 5 coils of No. 22 michrome wire connected in parallel. Instead of this arrangement a single coil of larger wire could be used. The No. 22 wire was used since this can be readily secured, being sold by the mail order houses and others for repairing the heating elements in electric toasters and similar heating devices. Since the lamp requires a current of 15 to 20 amperes for efficient operation, more than one coil in parallel of the No. 22 michrome wire is necessary to give carrying capacity. The wire is ordinarily sold in spools having a total length of fifty feet, but coiled in one-fourth inch coils to a much shorter length. One-third of a spool is used for each coil. The coils of wire are fastened at the ends to the disks of sheet brass or copper 2 inches in diameter which are bolted or riveted to the fiber disks. The fiber disks are held rigidly 13 inches apart on the threaded rod by means of jam nuts. Another method of attaching the copper or brass disks is to clamp them between two pieces of fiber or asbestos board held by two nuts on the threaded rod. The resistance wire is fastened to the disk by hooking the end of the wire through holes punched in the disk. The sheet iron disks which form the top and bottom of the resistance housing are attached to the rod by means of jam nuts on both sides. These top and bottom disks are made with four tabs about ¾ of an inch wide and one inch long, extending outward from the periphery.

The Tabs

Each tab has a hole large enough to take a ⅛ or 3/16 inch bolt. The tabs are bent at right angles to the disk; the ones on the top disk being bent down and on the bottom disk up. Two pieces of sheet metal one inch wide and 14 inches long are drilled with holes to match the holes in the tabs on the two disks when bent to a circular shape. They are bent to shape and bolted to the tabs forming the extreme upper and lower portions of the cylindrical housing. The ends of each of these sheet metal strips are bolted together on both sides of the ½ inch steel rod to the top of which the regulating mechanism is attached. The sides of the housing are covered with ¼ inch mesh wire screen which is fastened between tabs of the top and bottom disks and the sheet metal strips referred to above. A switch is mounted on the top of the resistance housing and a porcelain receptacle to the bottom of the housing.

The method of assembling the parts is shown in the photograph. The carbon adjusting mechanism is mounted on a ½ inch steel rod 48 inches long which fits into the base of a music stand. The regular rod with the music rack is removed from the stand and the steel rod inserted. This allows adjustment for height. A reflector is bolted to the framework of the adjusting mechanism.

The Reflector

A reflector may be purchased or one may be made from a tin pail. The latter will not be quite as good appearing as a regulation reflector, but will give very satisfactory results. A ten quart pail of light tin plate may be used. An opening 2 inches wide should be cut from the middle of the bottom to allow the carbons and the regulating mechanism to slip in. A sector of tin plate having a width of 2 inches across its widest part should be attached to the bottom side of the reflector just inside the large opening. This is to catch any sparks falling from the carbons. The resistance is bolted to the upright rod just below the regulating mechanism. The wiring is simple. A piece of lamp cord connects one of the movable carbons to one side of the switch on the resistance. The other switch terminal is connected to one end of the resistance. The opposite end of the resistance is connected to one terminal of the receptacle on the bottom of the resistance housing. The other terminal of the receptacle is connected to a long piece of lamp cord leading to a plug. The other wire of the lamp cord is connected to one of the movable carbons. A twenty ampere fuse is screwed into the receptacle. The heavy appliance cord is preferable to lamp cord for connections, since the lamp requires a current of 15 to 20 amperes. The outside of the reflector and the resistance housing may be given a coat or two of black stove enamel.

Special therapeutic carbons should be used in the arc. Several types of these are put out by one of the large carbon companies and can be secured from dealers in electrical and medical supplies. The "Sunshine" carbon produces light which approaches close to that of sunlight. The "B" carbon gives less light than the "Sunshine" carbon, but produces more ultra-violet rays. The eyes should be well protected when using this carbon. Carbon "C" gives still more ultra-violet than "B." Carbon "D" is the ordinary type of carbon and is not, in most cases, desirable for therapeutic work. The "E" carbon produces small amounts of ultra-violet but is strong in infra-red rays. It is of value where it is desired to apply penetrating heat. The "F," "G," "H," and "K" carbons are of special applications, and will not ordinarily be used.

When using the arc the eyes of both operator and patient should be pro-

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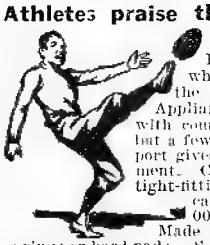

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tected by smoked glasses or goggles. Instead of wearing goggles the patient's eyes may be bandaged to keep out the ultra-violet rays. The arc should be plugged into an outlet designed for electrical appliances, requiring a heavy current. Do not plug into a light socket. Be sure the circuit is fused for at least 20 amperes. To start the light turn on the switch and by means of the hand wheel bring the ends of the carbons together. Immediately begin to slowly separate them until the maximum arc is obtained. Once adjusted the arc should burn steadily 15 or 20 minutes or even longer without further adjustment.

The patient being treated should be about three feet from the lamp. The first treatments should not be over about five minutes in length on each side of the patient. After being treated on one side, the patient should turn the other half of his body to the lamp for the same length of time. The amount of exposure will depend on the kind of carbons and the characteristics of the individual. Excessive reddening of the skin during the treatment is usually a sign that the treatment should be stopped on that side. It is not necessary to tan the patient to secure beneficial results. The tan acts as a protective means to the skin and lowers the efficiency of the treatment. As much of the body should be exposed to the rays as possible during the treatment since the effectiveness of the treatment is a function of the surface radiated.

SCIENCE AND INVENTION is suspending temporarily the Financial Section. Until further notice, readers are requested not to contribute material for this department.

Reclaiming Zinc from Dry Cells

VERY often the experimenter has a use for zinc and that of a dry cell would be satisfactory if it were not for the difficulty in cleaning out the container.

A method that is wholly satisfactory is to connect the plus and minus terminals of the cell to two wires coming from a transformer having an output of about 10 amperes at 10 volts. In a minute the cell will become warm and the gases formed will cause the insides of the cell to be forced out, leaving the zinc container relatively clean.

When using this method, the cell should be in a horizontal position as the contents are usually expelled with considerable force.—*Laurence E. Lechleitner.*

Iodine Remover

TO a little tincture of iodine in a test-tube, add a solution of sodium thio sulphate (hypo) and it will turn white. The solution can be used for removing iodine stains from clothing or hands.—*Benjamin Heller.*

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Manhattan	Harvard Cocktail
Tom Collins	Careless Love
Golden Fizz	Widow's Kiss
Bacardi Rickey	Horse's Neck

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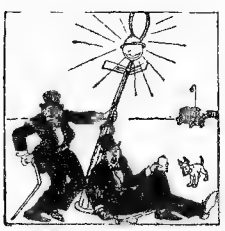

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Solution to "American Fan Tan"

My Chinese friend's opening play removed all five of the quarters, the only play that would surely win for him.

The remaining groups of two, four and six coins, insured him of being able to leave me with further groupings of 1, 4, 5; 1, 2, 3; 1, 1, 1; or reducing the groups to two—4, 4; 3, 3; 2, 2; all of which are losing stages for the player who must deal with them.

Solution to "Science on the Farm"

Tom Brown's statement to the effect that placing his poles three feet apart around his square piece of land would find a shortage of 400 poles, whereas, placing them nine feet apart would leave 800 poles uncalled for, reveals that between the two methods there was a difference of 1200 poles.

By the more extravagant method, a distance of 9 feet would call for three poles, while by the other method that distance, 9 feet, would require but one pole, a saving of two poles. If in a distance of nine feet, he could save two poles by the more economical plan, then how many feet must there have been in the fence line to account for the actual saving of 1200 poles? The question is answered by dividing 1200 by 2 and multiplying by 9. Thus we establish the perimeter of the square as 5400 feet. One side being 1350 feet, the area of the land must have been 1,822,500 square feet, or 41.83 plus, acres.

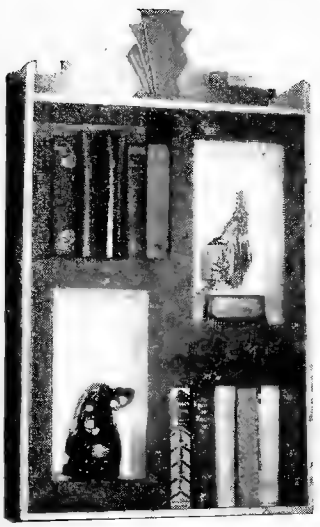
Why Not Light Up Those Dark Corners?

(*Continued from page 614*)

these frames was fitted a piece of white frosted glass. Two small ten-watt lamps were fastened inside each frame, connected in series, and received their power from a convenience outlet. The light from these lamps is diffused through the frosted glass, illuminating the figure above. In the open sides of the frames mica or heavy parchment may be used. The light filtering through this gives a warm cozy glow to a somber corner.

Another unusual application of light is shown in the mirror lights illustrated. These fixtures are also quite simple to make. They consist of two long boxes, four inches wide, four inches deep and twenty-eight inches long. The front and back are made of wood and painted black. The two sides are of white frosted glass. In the center is a partition of wood which is thick enough to carry a socket both on the upper and lower side, holding 40-watt tubular lamps. A small tumbler switch is used to control these lights, and is also painted black so that it is not conspicuous. In making these lights, the dimensions allow for the length of two of these tubular lamps in their sockets. It must be four inches square to diffuse the light, for if it is smaller a bright streak will be visible from the filament. The fixtures are hung from the molding as a picture would be, and the wires carrying the current are run along the supporting wires to the molding, and from it to a convenience outlet.

Bookcases frequently offer opportunities for effective lighting. The one illustrated is in the same modern style as the mirror lights. The top, bottom and sides of the sections containing the ornaments are made of frosted glass.



25-watt tubular bulbs account for this lighted bookcase

Twenty-five watt tubular lights are placed in the partitions back of these glass panels and shed a glow of light on the ornaments. A small 10-watt lamp in the center at the top silhouettes the vase. The frame of the bookcase is painted black and the edges outlined in silver, but the background in the lighted sections and behind the vase may be of a bright color for contrast. The sectional drawing shows how the lamps and connections are arranged.

Light may be used for convenience as well as beauty. Many closets are so placed that almost no light enters them from a central fixture in the room. A lamp in a porcelain socket placed just over the door inside the closet will prevent groping around in the dark for a lost article. In fruit closets and dark pantries they are indispensable. These closet lights are often controlled by a door switch which turns the light on when the door is open and turns it off again when it is closed. A pull chain lamp socket with a luminous pendant is sometimes used.

Two wooden boxes, painted black, with sides of white frosted glass—and you have an illuminated mirror!

A lighted refrigerator is now on the market, which makes use of this same principle. Each time the door is opened a light in one of the corners comes on, showing everything on the shelves. Many refrigerators are placed away from the windows and one always stands directly in front of them cutting off their own light, so that such an arrangement is extremely useful.

A new and convenient device recently developed is a small pilot light on the switch plate. These are lighted only when the switch is on and the electricity they use is almost negligible. There are countless places where they may be used in the home to save the electricity a larger lamp would consume if neglected. They may indicate when the attic, basement or garage light has been left burning or when an iron is forgotten. The latter use is most important, as one never knows whether an iron is heated or not.

Lamps have their novel uses in the garage and conservatory as well. An extension cord, with a rough service bulb, is a necessity when you are repairing your car at night. A newer use is to leave it burning under the hood on a cold night to prevent the radiator from freezing. A lamp can also be left burning near plants to prevent their freezing if they are on an unheated sunporch during the winter.

The experimenter in home lighting

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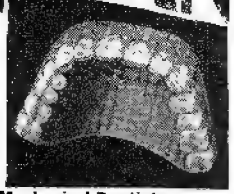

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will find these suggestions an interesting beginning. They will lead him farther to more fascinating applications of light as an expressive means of twentieth century decoration.

A tiny lamp in a porcelain socket is placed behind the clock. It is then connected to the convenience outlet nearby. . . . A light is flashed upon the picture above on the mantlepiece.

Man-Made Models

(*Continued from page* 596)

figure, Mr. Noell explains, depends largely upon intelligent handling of lights and shadows, the camera angle, and other knacks of the cameraman's art.

The lower of "The Distinguished Set" photos, prepared by Van Dyke Cigars, illustrates this point very well. While the same general process was employed in its construction—figures being molded of plasteline upon wire framework, and backgrounds and settings of cardboard overlaid with clay—expert photography was required to help turn inanimate plasteline into human, swaying fencers, their graceful shadows lending vividness to their movements.

The lady with the cigarette case was treated a little differently. To add to the depth of the relief, the background was painted black. As the plastic material contains fat, it was necessary to mix the paint with soap before applying, in order to have it adhere to the plasteline.

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How They Make It

(Continued from page 631)

In addition they are used in many instances as roofing tin in place of the purposely made sheets. I saw a gate made of them, the framework of the gate being made of wood with the flattened out cans used as a covering for the wooden skeleton. And I saw an automobile in San Jose one day which had a new running-board of a flattened gasoline can.

But these are not all of the uses. Cocoanut graters, cake pans, milk measures, biscuit pans and almost anything and everything that one might expect to see in a kitchen are made from gasoline cans. A chocolate candy manufacturer in San Jose who makes tin boxes out of the same old cans, frequently not even taking the trouble to remove the gasoline label.

Just where this use of empty gasoline cans will stop is more than I can say. Just before I left the country I talked to a coffee man in Cartago, a Costa Rican, who was planning to ship ground coffee in empty gasoline cans to the large hotels in the States.

While gasoline cans are the most useful useless thing that one finds in Costa Rica, they do not form the whole refuse pile that is converted into usable commodities. The lowly metal case binding that is so much in use on cases for export is carefully pressed flat where it has been twisted in removing it from the cases, and all sorts of fancy flower baskets are fashioned from it, some even going to the extreme of being combination flower baskets and tabourettes.

Uses for Other Cast-Offs

Other odds and ends are used profitably for various purposes. A candy manufacturer in Alejuela uses a candy-mixing machine, the gears on the turning arrangement of which are made of an old driving pinion and ring gear from a discarded Ford.

A woodworking shop in San Jose has a bandsaw that was made by the owner of the shop, the principal parts of which are two discarded bicycles wheels, with the inside of the rims lined with leather strip.

Discarded railroad track is frequently used for electric light wire poles in Costa Rica, and in San Jose pieces of dicarded railroad track have been used to lend strength to a new sidewalk.

A fence around a part of the railroad shops in San Jose is built of discarded metal railway ties and railroad track, around which concrete has been poured.

An undertaker in Cartago, Costa Rica, wishing to run a pair of stairs to an upper floor for his assistants to use as a sleeping room solved the problem by using ordinary wall brackets for supports for the treads of his stairs. Since the undertaker has his own woodworking shop where he makes his own coffins he made the entire stairs himself with only limited expense.

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On the Shoulders of the Wasp

(*Continued from page* 591)

than that before all the orchardists were convinced that a silly bug was necessary for the culture of this particular variety of fig when other varieties all over the state were being grown without it.

When growers first became seriously alarmed by molds, smut, souring, and other troubles in their figs, they tried to explain them as being caused by faulty irrigation, atmospheric humidity, cool nights followed by hot days, and scores of other environmental conditions which were not fundamentally involved. Then the California Peach and Fig Growers Association called for aid. A young specialist in subtropical horticulture, I. J. Condit, was drafted from the University of California to make an investigation. He brought with him two young women, Edith Phillips, research associate, and Elizabeth Smith, assistant pathologist, and set them to work studying fig smut.

24,000,000 Pounds of Figs Annually

They soon found that they had been given no sinecure. The sun-baked orchards of the San Joaquin Valley were their laboratories, fruit boxes were their desks, and study material piled up around them, literally in tons. But the future America's dried fig trade depended upon solving the problem, for California produces practically all of the dried figs in the United States, 24,000,000 pounds annually. Month after month they opened blighted figs, studied them under the microscope, made notes, and raised strange fuzzy colonies in test tubes, from the oozing or desiccated remains of fruit. They found that none of the factors conjured by growers were primarily to blame. The figs were not suffering from poor environment—they were sick. This trio of investigators demonstrated that specific kinds of fungi, bacteria and yeasts lay at the bottom of the various forms of rotting, molding and souring, and uncovered evidence that these diseases were carried by insects. More important still, their report indicated that smut was not the most deadly of the diseases—that there was another, more serious malady attacking the Smyrna figs.

This latter lead was further investigated by Panos D. Caldis, a candidate for the Ph.D. degree at the university. He went through the same procedure as his predecessors, splitting open countless Smyrna figs, and making exhaustive tests. His studies demonstrated that there was a disease peculiar to the Calimyrna fig, a fungus growth to which he gave the same *endosepsis*. Furthermore, to the horror of the growers, he found that the indispensable fig wasp was to blame. In leaving the Caprifigs, the female wasps picked up the spores of the fungus on their wings and infected the Calimyrna figs as they spread pollen.

It is doubtful if any industry has ever been faced by a situation more complicated. Some means had to be found of stopping a disease carried by a scarcely visible insect without which the industry could not live. Two more scientists were drafted from the University of California College of Agriculture, Dr. R. E. Smith, professor of plant pathology, and H. N. Hansen, another graduate student. They made a careful survey of the situation. The Caprifig tree produces, typically, three crops a year, the mamme, the profichi, and the mammoni. The wasps grow within these Caprifigs. As each crop matures, the female wasps emerge in hordes from the orifice which is found on the broad end of each fig, enter the orifice of each young fig of the next corp, and lay their eggs in the tiny blossoms which line its interior. The male wasps never leave the Caprifig in which they are born, but each generation of females migrates to the young figs which develop just as the previous crop reaches full maturity. It is this migration of which Smyrna or Calimyrna fig growers take advantage. When the profichi crop, the only one that produces pollen, is ready to disgorge its legions of female wasps, the growers pick the Caprifigs and transfer them to the Calimyrna trees. The female wasp leaves the prifichi fig as usual, covering itself with pollen from the blossom stamens, for the fig is really a closed tree flower. Not knowing that it has been moved, the wasp enters the orifice of a Calimyrna fig to lay its eggs. But there the plot is discovered, for the style of the Calimyrna flower is too narrow and deep for the ovipositor or egg-depositing organ. The distracted wasp stumbles and buzzes around the interior of the fig, fails to lay its eggs, and finally gives up, but not before it has dusted the precious pollen in every cranny of the expectant fruit.

A typical orchard of Calimyrna figs.

The problem that faced Professor Smith and Hansen was to keep the wasps from transferring the spores of the dangerous fungus during these migrations. They decided to concentrate on one migration, that from the mamme crop to the profichi, so that this latter pollen-bearing crop would be clean when the wasps forced their way out and took up the task of fertilizing the Smyrna figs.

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Hansen thought of many ways of attacking this problem, but finally decided that the mamme crop would have to be treated with a fungicide just before the wasps came out. For his experiment he selected a few isolated orchards in the San Joaquin Valley, and to make the task less complicated, he stripped the trees of every mamme fig not needed for the implantation of the all-important profichi. There are thousands of figs hiding in unexpected places on each tree, and before he was done he wished that he had started to clean the Augean Stables. Then he took up the delicate work of sterilizing the remaining figs without killing the larvæ of the wasps. Patiently, fig by fig, he injected a fungicide solution, using a small hypodermic syringe.

After the stage had thus been set, it was necessary to wait for results until the profichi crop was implanted, and then until the Calimyrna figs were fertilized, months later. To the delight of the experimenters, the experiment was successful. The wasps were not killed, and the condition of the test orchards was improved. But it was demonstrated that the fungicide only temporarily discouraged the fungus, and that unless the wasps came out within a few days after the treatment, they picked up fungus spores just as before. Also, it was realized that to expect growers to go about injecting each Caprifig with a hypodermic needle was to suppose that they had the patience of Job.

Sterilization of Mamme Figs

Further experiments showed that the sterilization of the mamme figs could best be done by picking them from the trees, splitting them, and dipping them in tanks of fungicide. Even by this method, it was difficult, but so great was the crisis that the growers asked that the method be tried, and tried on a stupendous scale. In 1928, under the direction of the University of California, an attempt was made to destroy all unneeded mamme figs in the State. The rest were sent to a central treating plant, where, by means of an incubator, the wasps were hatched while the fungus on the exposed surfaces of the figs was dead. Thousands of test tubes were placed over auger holes in the sides of the incubator, and the wasps, attracted by light, entered them. These tubes were sealed and shipped back to the orchards as needed.

The ensuing crop was the smallest in years, but in spite of the fact that stripping the trees was almost beyond human capacity in the time available, that it was impossible to handle the dipping and incubating fast enough, and that some of the growers were too sceptical or too lazy to clean their orchards, the theory of the plan was proved correct. In districts where the program was carried out religiously a remarkable improvement in the quality of the figs was noted.

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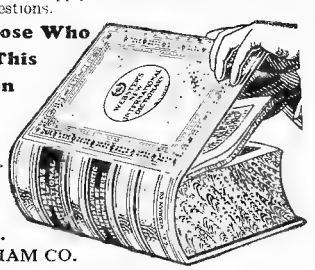

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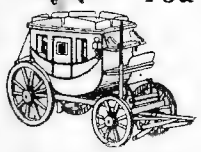

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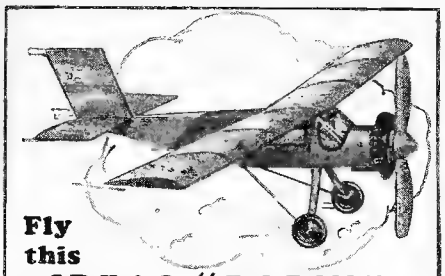

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How to Form an Outboard Club

(*Continued from page* 601)

Or "C" class can be substituted for "B" as there is very little difference. Most "B" motors are able to run with the "C" class with no trouble, and by combining the classes more entries and far more exciting races are the rule.

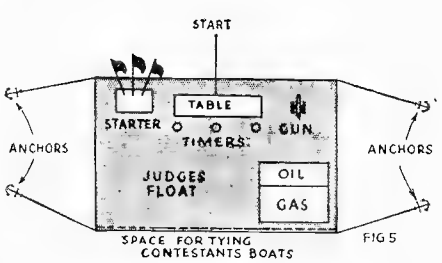
A family boat event is also desirable as it gives every one owning a boat and motor the chance to compete and as most of the so-called "family boats" have a turn of speed often up to 30 M. P. H. they make very attractive spectacles, with their varigated colors and designs flashing over the water in unison.

The National Outboard Association has classified drivers into divisions of amateurs, near-professional and professional groups. This is alright where a hundred boats are competing, but in a local regatta it cuts competition to the point where many times only three or four boats will appear for a given heat.

Outboard racing must consider the spectator in order to grow in popularity, and the spectator loves excitement! Three or four boats don't make many shivers run up and down the human spine, but fifteen or twenty boats in a race provide real thrills! And I urge the smaller meets to do away with division and let everybody run in his proper class as there is very little, if any difference in the relative speeds of the so-called "hopped up" motors and those of the simon-pure stock variety.

Sometimes in a small regatta, by letting the first three boats to finish a heat, compete in the next higher class, many extra entries and thrills are the result.

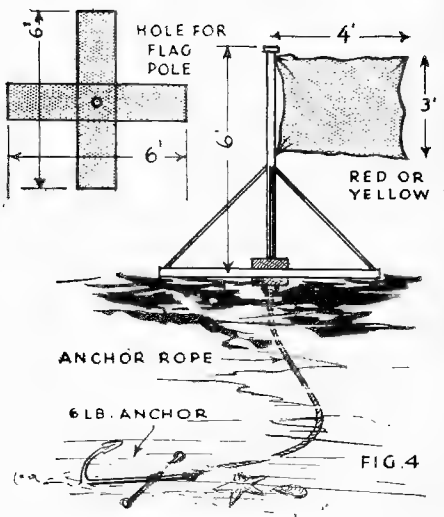
Three judges, a starter and three timers can handle most any race. The judges should be equipped with binoculars. They watch the progress of the race, cutting buoys, fouling and other troubles. The timers should have stopwatches or a central chronometer and should time their boats independently of e other. A small cannon or shot gun should announce start and finish. It is also good policy to fire a gun five minutes in advance of each event. A one minute gun can be used to good advantage and a checkered flag should be used to wave down contestants at the finish.



Arrangement of judge's float.

The pole boat is preferably a runabout capable of about 25 M. P. H. The starter should have three flags. Yellow, red and white. The yellow should be displayed as he makes a large circle inside the course giving all contestants time to line up alongside and as nearly abreast as is possible.

When the boats are in the proper position and headed for the starting line the white flag should be raised to signal drivers that the race is on. If the boats do not align properly, red should be displayed indicating a false start. The same procedure prevails if the boats are forced to run by the dock or barge in order to start. A gun should be fired the instant the boats cross the starting line and when the first boat finishes.



How to make marker buoys.

Several fairly fast boats should be used to patrol the outside of the course and keep spectators away from contesting boats. These should be marked by a distinguishing flag or other marking showing the authority invested.

Turns should be made to the left, on the right hand side of the markers, and any contestant cutting a buoy or marker should be disqualified unless he remakes the turn in a proper manner. Protests should be made immediately following the finish of a heat or event.

Where there are not many boats available, events run off in three heats for a class will lengthen the program. But as this method involves complicated scoring, it is advisable in small regattas to run the event as a race. So many times around the course until the total mileage is run off. Five or six miles is plenty, except for the free-for-all event which should be ten or fifteen miles to give every boat a chance to display endurance, as well as driving and mechanical ability.

Loving cups are generally given as prizes, but a few merchandise trophies donated by enterprising merchants of the town provide an added attraction and give contestants something useful as well as ornamental.

The grand prize should be for the free-for-all event. Other classes should

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be awarded equal prizes in each position first, second and third. Another mighty popular attraction is a souvenir medal or badge to each boat competing. This serves as a stimulator in future events and somewhat gratifies the "also rans."

Of course Saturday afternoon, Sundays or Holidays will turn out the largest crowds and it is vital that the race committee have a publicity committee working well in advance of the meet to stimulate public interest.

Out-of-town competition is always to be encouraged as it makes rivalry keener and will often make the home town boys turn out for the express idea of beating so-and-so from the other town and will lay the foundation for a race meet in the other fellow's locality so he may redeem in his own back yard any lost laurels.

Facilities for docking, repair work to motors and hulls and a good supply of fuel and lubricant should be provided by the race committee close to the starting line and the local sporting goods or garage man can do a favor by having some one at hand with a supply of spark plugs, shear pins, cotter pins, starting ropes, and an extra propeller or two.

So, with a course, some boats, adequate prizes obtained by the prize committee, a publicity committee and a race committee, you are "All Set" for the big day. More power to you and may your regattas be many and successful.

In the next issue, Mr. Dykes will give full plans for building an outboard boat. It will be an exact replica of his own boat, which he constructed, and with which he has won 29 out of 31 races.

ARTICLES of this type can cover only in a general way a subject that in many cases calls for detailed treatment. If Mr. Dykes can help you solve any problem regarding hulls, motors, parts, fuels, racing rules, the formation of clubs, or the managing of regattas, let him know. He'll be glad to give you all the information at his command. Write on one side of the paper and enclose a stamped envelope for his reply.

Be brief and specific. Questions likely to interest many outboarders will be answered in these columns. Otherwise your problem will be treated in a personal letter from Mr. Dykes or from some other authority on the subject involved.

Magic

(Continued from page 625)

tator, and held with the writing toward the floor. It is then pushed into an envelope, the envelope sealed, and then held to the forehead of the magician, who correctly divines its contents. The envelope is torn open and the card returned to the spectators. The effect is carried out by slitting the envelope with a razor blade and in the act of pushing the card into it, permiting the card to pass out through the slit, as the envelope is held to the forehead, the message is read. Tearing the envelope to get at the card destroys the evidence.

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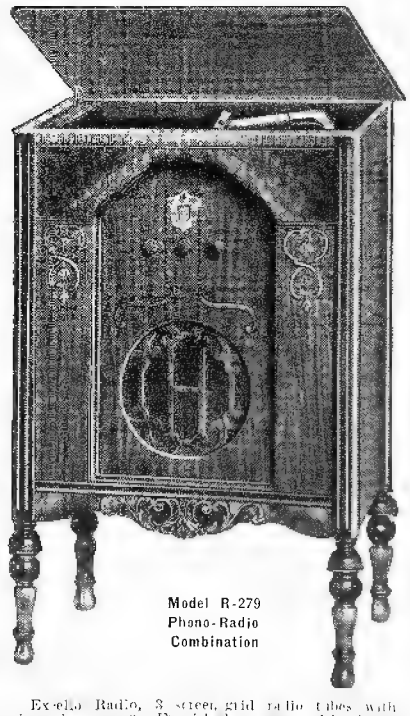

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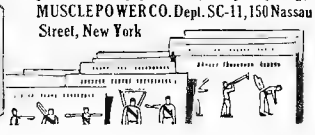

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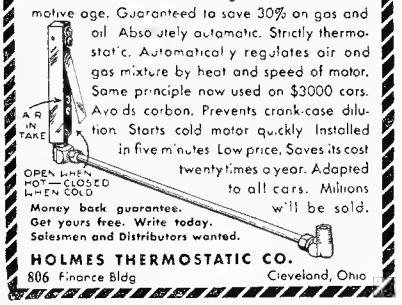

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Wrinkles and Recipes

(Continued from page 624)

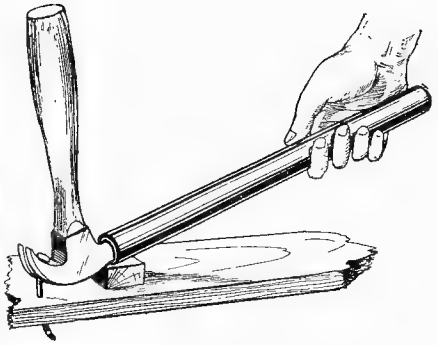
Parchmentizing Paper

IN this day of lampshade making there is a constant demand for lamp coverings that will look antique. Common drawing paper of the white variety may be treated so as to resemble old parchment very realistically. A bar of paraffin is melted in an old pan. Then, the paper to be treated is placed on a large sheet of clean new wrapping paper which has been placed on a smooth, flat surface. Do not use paper with print on it as the ink comes off the paper to be waxed. A clean rag is dipped into the melted paraffin and rubbed, with a circular motion, on the drawing paper. This is done until the entire surface of the paper is covered with a thin coating of wax.

Now, a second piece of wrapping paper is spread over the waxed drawing paper. This piece is indicated in the left hand diagram above. A hot iron is applied to the entire upper surface of the second piece of wrapping paper. When a transparent spot corresponding to the shape of the waxed sheet appears on this paper the process is finished. The result is an artistic looking piece of parchment.—*Clyde McClary, Jr.*

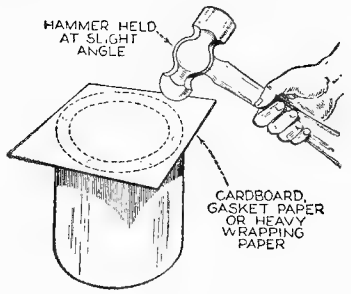
Drawing Spikes

TO overcome the danger of breaking the handle of a carpenter's hammer while pulling spikes, bring into use a piece of old gas pipe 20" long and proceed as shown in cut.—*E. Peterson.*



Easy Method of Making Gaskets

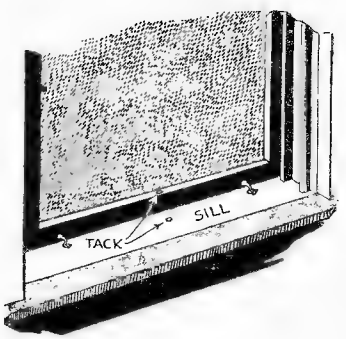
GASKETS of any shape or size may be easily made by obtaining cardboard, heavy wrapping paper or gasket paper, free from cracks or flaws and placing it over the work on which it is to be used. Then take a hammer and tap lightly around the edges of the parts which must be cut out. Hold the hammer at a slight angle and each blow will cut through. The ball peen of the hammer will also cut the holes though a punch may be used.—*Joseph D. Amorose.*



Locating Cotter Pin Hole

BY filing a small line across the end of the bolt exactly where the cotter pin hole is drilled and doing this before the cotter pin is extracted it will be a simple matter to line up the nut when replacing the cotter pin.—*Joseph D. Amorose.*

Window Screen Markers



INSTEAD of purchasing two sets of numbering tacks to identify window screens so that they can be fitted into their matched window frames, one may use brass headed tacks if they are placed in such positions that identification is possible.

For one screen and its window casing, drive a tack in the center of the screen and also in the center of the casing. For another window, drive a tack on the left hand side of the screen; and the left hand side of the casing, and for another drive a tack on the right hand side of the screen and one on the left hand side of the casing. Two tacks can be driven into the left hand side of the screen and two more driven into the window sill opposite marks this particular screen for this particular window casing. The number of combinations are unlimited, and of course, if the tacks are spaced far enough apart, no difficulty will be had in selecting the particular screen for the window.—*R. Wailes.*

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Making Room for Motor Cars

(*Continued from page 602*)

through the establishment of a comprehensive traffic signal system. Still another step was the abolition, in 1928, of parking in the Loop. Results seem to show that this measure has been a help.

It has speeded up all kinds of Loop traffic and has apparently lessened accidents to pedestrians and motorists alike. And it seems not to have affected business adversely; in fact there are those who assert that it has been decidedly beneficial, through making the shopping district more accessible to the average purchaser. Additional advantages are reductions in the cost of street cleaning, and time saving in deliveries by cartage companies.

Following the 1926 survey, a new city traffic code placed Chicago among the foremost American cities in scientific supervision of traffic. This system includes a City Traffic Engineering Bureau, with a supervising traffic engineer empowered to investigate and make improvements. It includes also a City Traffic Court and Traffic Violation Bureau.

Accomplishments for the improvement of Loop traffic conditions during recent years include the widening and double-decking of Wacker Drive, which follows the outer contour of the Loop on the north and partially on the west side. This includes a double-deck traffic bridge across the Chicago River at Michigan Avenue, the widening of Canal Street; and the completion of Roosevelt Road, just outside the Loop, to give much needed street outlets over the railway tracks to the south. A further important project still under way is the straightening of the Chicago River south of the Loop, which will enable the extension of streets.

Still another important feature of traffic relief is the municipal automobile parking area in Grant Park, within a few minutes' walk of Loop skyscrapers. This parking area will accommodate several thousand cars and has possibilities for indefinite expansion.

It was estimated, as a part of the 1926 traffic investigation, that there was a loss to Chicago for the year 1925 of $17,000,000, as the result of personal injuries and property damages from automobile accidents; and this amount did not consider economic losses from delayed traffic. It was assumed, at that time, that the city traffic and city safety problems were closely related. This assumption seemingly has been confirmed by the fact that Chicago was one of the few American cities to show a substantial reduction in automobile accident fatalities in 1929.

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P. O. Box 700, Cincinnati, O.

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MAKE UP TO $40 A DAY
Showing My Mystery Lighter to Men. What Makes It Light? All Guaranteed. No Flint or Friction. New Principle of Ignition. Sample With Sales Plan 25c. Sample Gold or Silver Plated, $1.00. Agents write for proposition.
NEW METHOD MFG. CO.
Desk SI-11, New Method Bldg., Bradford, Pa.

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Begin Today—Write for My FREE BOOK. I can make a good penman of you at home during spare time. Write for my **FREE BOOK, "How To Become a Good Penman."** It contains specimens and tells how others mastered penmanship by the Tamblyn System. Your name will be elegantly written on a card if you enclose stamp to pay postage. Write today for book.
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"How to Make It"

For the Man Who Likes to Build Things Himself

SO often a little knowledge will do the trick—and here's the book that will tell you how to do it.

"How to Make It" is a veritable treasure-house of information for the man who has the urge to learn to do things for himself. In it you will find full instructions for making over a hundred helpful and unusual things. For example, it includes full details for making all kinds of furniture, fireplaces and lamps. Also the making of a telescope; for building a model tug-boat, a deaf-phone that is of real benefit, a small lathe, a telegraphone, an enlarging machine, and numerous other articles that bring joy to many families.

A copy of "How to Make It" costs only a quarter. Simply clip and mail the coupon below with 25c in stamps or coin to the Radio-Science Publications, Inc., 381 Fourth Avenue, New York, N. Y.

ONLY 25c COMPLETE

Clip and Mail Coupon

RADIO-SCIENCE PUBLICATIONS, INC.
Dept. 2511, 381 Fourth Avenue, New York

Gentlemen:
I enclose 25c, for which please send me your book, "How to Make It."

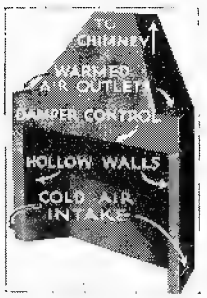
Name.....

Address.....

City..... State.....

Fireplace Charm with Furnace-Like Heat

THE Heatilator, representing the latest in fireplace equipment, has recently been put on the market by the Heatilator Company. It combines the advantages of a fireplace with those of a hot air furnace. It consists of a double metal shell, which constitutes a complete fireplace except for the bricking-in and ornametal covering, which you may have any style you desire.



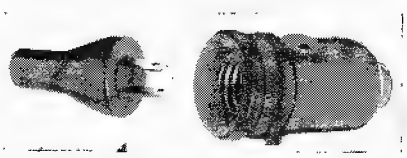
This sketch explains the course of the cold air through the heater.

Heatilator Company

Openings into the hollow space within the double shell are provided. In the finished job these are connected to small registers set in the walls near the fireplace. When a fire is started, air is drawn in from the room through one register, circulates within the hollow walls of the shell where it is heated, and then passes out into the room through a register set higher up. Thus the room is heated both by the direct radiation from the fire and by the constantly circulating air, warmed within the metal walls.

Safety Rubber Plug and Push-Socket

IF you are troubled with fuses burning out, the new Protex rubber sockets will, undoubtedly, interest you. Broken plugs or short circuits (caused by small wires coming into contact with the opposite binding post) can be largely eliminated by the rubber plugs and sockets. The terminals in the rubber plugs are separated from each other in such a way that contact between wires is impossible. There are no exposed surfaces. The shells, instead of being made of hard material, are made of soft rubber which can be stepped on or thrown down without breaking. They come in various sizes for household or industrial use. You may purchase either a push or keyless type socket.



Daniel Woodhead Company

The Most Interesting Evening I Ever Spent

UP TILL 9 o'clock the party was a complete flop. Then Tom walked in. Tom's a live wire, if there ever was one.

He said he'd heard about a one-man show anyone could perform with the help of a book he knew about. He had sent for that book, and said he was going to put on the show.

We thought he was joking and laughed at him, but he sat us all down in the living room, got out a pack of old playing cards, and started to do things that made our eyes pop out of our heads.

For over 2 hours he made those playing cards almost talk. What he could do with those cards just didn't seem human. After it was all over, the gang all crowded around, shaking his hand, and patting him on the back. The girls all said, "Oh, Tom! You're wonderful!" It was by far the most interesting evening I had ever spent.

I asked him how he learned it all. For answer he pulled out a shiny new quarter, and said that one just like it had taught him every trick he had showed us.

And it was a fact! Tom had simply enclosed a quarter with the coupon below and gotten Walter Gibson's Famous Book of Popular Card Tricks by return mail. You, too, can entertain yourself and your friends with the 101 card tricks it teaches. No sleight of hand is necessary—no hard work to learn. Simply read the book carefully and you can do every trick in it.

And it costs only 25c! Send for it today.

Radio-Science Publications, Inc.
Dept. 2511, 381 Fourth Ave., New York

I enclose 25c (in stamps or coin) in full payment for Walter Gibson's Book of Popular Card Tricks, which, it is understood, will be sent me by return mail.

Name .....

Street and No. .....

City ..... State .....

Blueprints on the Scout Secondary Glider Will Be Available Shortly. Put Your Order in Now.

The Safety Valve

(*Continued from page* 584)

Here's a Real Ordinance

WE have worked for several years to frame an ordinance, or law, that will put the mediums out of business, by preventing their advertising in any manner.

We believe we have one now that will get around the "religious defense."

The same is enclosed herewith, and we would like your opinion on it.

J. HERBERT PRATT,
Kosmon Printing & Publishing Co., 403-5 S. Tejon St., Colorado Springs, Colo.

We, the undersigned, residents of Colorado Springs, hereby urgently request the City Council to forthwith pass accompanying ordinance against pernicious practices which should never have been tolerated in this community. The necessity and expedience of this ordinance must be apparent to every member of the Council.

Ordinance No. ———

Be it ordained by the City Council of the city of Colorado Springs:

Section 1. No person, association or corporation, foreign or domestic, nor any agent, employee or officer thereof shall within this city, or by using any mail address therein, practise, exercise or teach the vocation, calling, profession or pretended science of clairvoyancy, palmistry, astrology, seership, mediumism, séances, reading, sittings, circles, demonstrations, advice, messages, crystal gazing, fortune telling by any method, fake healing systems, or exhibitions of like character; or any other like crafty, nefarious or superstitious science, vocation, calling, profession, carried on under the guise of religion, philosophy or science or otherwise, by whatsoever name called.

Sec. 2. It shall be unlawful for any person, association or corporation, foreign or domestic, or any agent, employee or officer thereof, to advertise within this city in any newspaper, periodical, circular, handbill, sign or signboard, billboard, by radio, moving picture show, by personal solicitation, or in any other manner, that he, she or it is carrying on, conducting or teaching any of the said crafty and nefarious callings, vocations, professions or sciences named in the foregoing section.

And it shall be unlawful for any owner, officer or person in charge of any newspaper, periodical, sign or signboard, billboard, printing shop, advertising agency, publicity bureau, radio station, or picture show, to broadcast, publish or distribute anything in this city which directly or indirectly advertises any of the above named prohibited callings, vocations or professions, whether located in this city or elsewhere.

Sec. 3. No person in this city shall use the prefix of "Doctor" or "Professor" to their name without proper credentials recognized by law.

Sec. 4. Any person violating any of the provisions of this ordinance shall be fined not to exceed three hundred dollars ($300), or imprisoned in the City Jail for not more than thirty days, or shall be punished by both such fine and imprisonment.

Sec. 5. All ordinances or parts of ordinances in conflict with this ordinance are hereby repealed.

Sec. 6. That this ordinance shall be in force and effect from and after its passage and publication as provided by the charter.

*(Well, well, we hope that you put this ordinance across. While fortune-telling is against the law in some states, there are many ways of getting around the rules. Laws sometimes are passed rather promiscuously, but no attempt is made to enforce them. Such laws are of little value. The District Attorney's office is generally too busy to take care of violations of mediocre ordinances. What we need now is more sane legislation, far less foolish legislation, and enforcement. While we consider such a law of value in ridding communities of vultures who prey on the minds of the credulous innocent, we doubt if any serious attempt would ever be made to enforce the ruling when it has once been made a part of the law.—*EDITOR.)

An Interesting Etching Hint

IN the August issue I read the article on "Etching" and, after starting to do it, I cut the work in half. I took a piece of celluloid and clamped it over the picture, then soaked the celluloid with acetic acid to soften it so a needle will cut deeply in the celluloid. Then I inked the etched celluloid with printer's ink, as you would the brass, and the results will be the same. When the acetic acid evaporates, the celluloid is almost as hard as brass.

WILLIAM L. HARKER,
Indianapolis, Ind.

Rates of Payment

How much do you pay to the contributors of "Wrinkles and Recipes," "How-to Make It" articles, etc.?

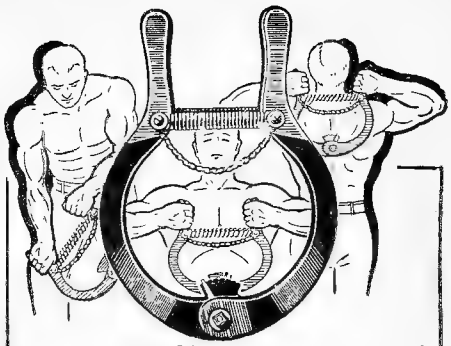
SHELDON BROWN,
Los Angeles, Calif.

(SCIENCE AND INVENTION *Magazine pays from 1c to 2c a word for all material accepted and published. Special rates are paid for good photographs and well illustrated articles. "Wrinkles and Recipes" are paid for at a rate of* $1.00 *each, except if long. Finished drawings are made by our own staff of artists, but good drawings should accompany "How-to-Make-It" and "Constructor" articles.*—EDITOR.)

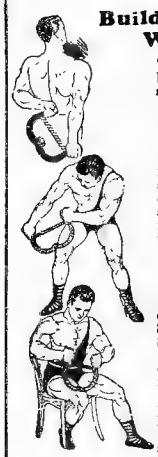
A Boost for Patent Advice

I HAVE just returned from Washington, D. C., where these ideas (four of them) have been recorded by my attorneys there. I talked so much to them of the wonderful service accorded inventors through your magazine, and they suggested I have your opinion on them before proceeding further. A strange suggestion, you no doubt consider it, but then I am related to these attorneys.

CHAS. H. REED,
Reed Publications, Houtzdale, Pa.



Build Muscles and Strength With This Iron Shoe



The Germans invented the Iron Shoe because they realized it enabled them to achieve physical perfection. We have brought it to America and improved it. It is offered you at a ridiculously low price. Every strong man uses one to build back muscles, tremendous chest and powerful giant-like arms. We show you how to develop abdomen and legs so that you will be a top-notcher in 30 days. We don't just ship the apparatus and let you work out your muscle building problems for yourself. We include with our

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the IRON MAN'S FAMOUS 60-DAY ILLUSTRATED PICTURE COURSE of exercise instruction, SPECIAL STRENGTH RECORDER and STRENGTH RESISTER, thereby making this the greatest body-building offer presented to you in a lifetime. It is the greatest muscle-building apparatus you ever saw. Write for particulars today and start getting strong at once. Follow the choice of champions and get that grip of steel. Ring in now on our special offer and learn all about the lowest priced and biggest result getting exerciser under the sun.

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Without any obligation send me free illustrated information on the Iron Shoe Strength Builder and Special Offer.

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Made of pure virgin wool paper mill blanketing with whipped edges. This blanket is the greatest value we ever offered. With reasonable use we will guarantee it 20 years. Size 66" x 78", weight 5½ to 6½ pounds. $4.45 postpaid. Large quantity purchases and slight imperfections enable us to make this low price. The most warmth and least bulk of any blanket made.

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Classified Advertising Manager—Experimenter Publications, Inc., 381 Fourth Avenue, New York City

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MAKE BIG MONEY with fast selling line of food products. Prize motor and tractor oils paints. Sure repeat orders. Write for FREE SAMPLE CASE. LOVERIN & BROWNE, 1622-D So. State, Chicago.

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Lyric Writers—I compose better music cheaper. Ernest Deininger, 2827 Papin St., St. Louis, Mo.

SONG POEM WRITERS—"REAL" proposition. Hubbler, D-191, 2104 Keystone, Chicago, Ill.

SONGWRITERS, POEMS, MELODIES—Opportunity. Tommie Malie, SINY 4215 North Ave., Chicago, Ill.

Stamps

CAYMAN ISLANDS—Astounding packet from Cayman Islands. Thirty other Unique, Interesting, Beautiful Distant Land Stamps (Richly Colored, Unusual Designs). Hurry! Rush! Get yours now. Free for 5c postage. Empire Stamp, Toronto, Canada.

Typewriters for Sale

TYPEWRITERS, all standard makes, $10 up. Fully guaranteed. Catalog free. Northwestern Typewriter Exchange, 121 N. Francisco Ave., Chicago.

Wireless

Learn Wireless (Radio) and Morse telegraphy. School, oldest and largest; endorsed by Telegraph, Radio, Railway and Government Officials. Expenses low—can earn part. Catalog free. Dodges Institute, Stone St., Valparaiso, Ind.

Scientific Book Reviews

WAVE-MECHANICS, by Arnold Sommerfeld. Published by E. P. Dutton & Company, New York City. VII; 304; price $6.25.

This is what may be termed a decidedly deep mathematical treatise on the constitution of matter. The book fairly bristles with mathematics. Many people do not know what a differential equation is. Here they can revel in any number of triple integrations. It is impossible really to review this book. If any investigator will turn to the last pages and go through the four page index it will give some clue to the range of the topics treated, as there is considerable text touching on the quantum theory and Bohr receives a due amount of attention, while Schroedinger is cited some fourteen times in the index. It is interesting to note that the word "proton" does not appear in the index, which in a way indicates a good conception of the subject. The word "electron" may be given as an example of the title assigned in the index to a number of pages in the book. A glance through the volume indicates that an appalling amount of work was expended by the German author.

AN INTRODUCTION TO THE STUDY OF WAVE MECHANICS by Louis De Broglie. Published by the E. P. Dutton & Co., Inc., New York City. VII; 249 pages; price $4.25.

We have just reviewed a book by Arnold Sommerfeld on Wave Mechanics. Here a distinguished visitor of France has produced a treatise on the same subject. We can say much the same about it that we have said above on the other book on Wave Mechanics. It is very advanced in its treatment, the subject being one which will not lend itself to any satisfactory treatment except by the aid of the calculas. It would be futile for anybody to attack these books who is not a good high-grade mathematician.

A FIRST YEAR PRACTICAL CHEMISTRY, by Dennis Brook Briggs. Published by J. M. Dent & Sons, London and Toronto, Ltd. V; 77; price $.50.

This little manual falls into a series on modern science topics published by the well known house of Dent. The book is definitely a treatise on experimental chemistry; from beginning to end it is experimental, even simple chemical formulas do not appear. After each section, there are some questions with which to test the work of the students in the laboratory. The experiments are of a type which runs into physics in some cases, but they are absolutely a part of a chemist's education. The outline drawings used as illustrations may be referred to as entirely practical, as they are far more explanatory than finished half-tone work would be. The work is of a type to excite a student's curiosity and it was curiosity which led the old chemists in their wonderful work. To the chemical graduate it may seem very primitive and too simple but the older one gets the more he appreciates the value of books which start at the very foundations of the science they treat of.

MANUAL OF FLIGHT, by Captain Ienar E. Elm, Air Corps Reserve, U. S. A. (Retired). Published by David McKay Company, Philadelphia; 157; price $3.00.

It is conceivable that some day you will fly. You really should know what to do in case of an emergency. Undoubtedly you are interested in flying in general, and a plane is more or less of a puzzle to you, perhaps.

Captain Ienar E. Elm has undertaken to write a book that "contains the fundamental knowledge of flying that should be part of the equipment of every man or woman who intends to fly either for pleasure or profit." The requirements to become a competent pilot are explained, the elementary and advanced maneuvers are similarly treated. The hazards of flight are discussed, from varying ground levels to a stall due to excessive climb. The operation of a Russell Lobe parachute, and an Irving parachute, are described. The various parts of a plane are explained, in language which the layman can comprehend. While the reviewer does not think one should attempt to fly after reading this book, he does feel that flying will be a good deal easier.

Particularly good is the dictionary of terms in back of the book. It contains a definition of the words connected with the flying industry.

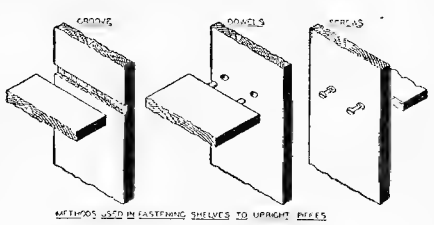
Modernistic Bookshelves

(*Continued from page 618*)

about two finish coats of the body color, let us say a lettuce green.

Painting the Design

THE next step would be to lay out either a full-sized paper pattern of the design or, better still, lay it out with a soft pencil directly on the article itself. In case the first method is used the spots of one color should be cut out and the paper used as a stencil, followed by other stencils, for other colors. If the pattern has been laid out on the wood, the design may be painted in, if care is taken, with small brushes.



Latest data on radio receivers for Dealers, Servicemen and Amateurs

The Radio Construction Library

WRITTEN by two widely known radio engineers, these three books cover every phase of building, repairing and "trouble shooting" on modern receiving sets. This practical Library includes: PRACTICAL RADIO—The fundamental principles of radio, presented in an understandable manner. Illustrated with working diagrams. PRACTICAL RADIO CONSTRUCTION AND REPAIR—Methods of locating trouble and reception faults, and making workman like repairs. Discusses modern Short Wave Receivers fully. RADIO RECEIVING TUBES—Principles underlying the operation of all vacuum tubes and their use in reception, amplification, remote control and precision measurements.

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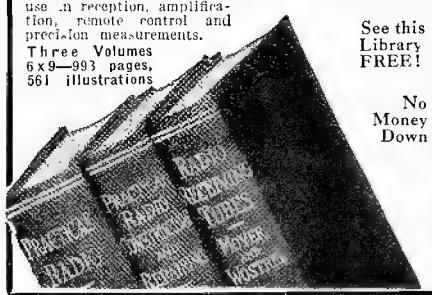

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370 Seventh Avenue, New York.

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1305 N. Broad St., Philadelphia; 85 Court St., Brooklyn

$1,000 REWARD!

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Crimes like this have been solved—are being solved every day by Finger Print Experts. Every day we read in the papers of their exploits, hear of the mysteries they solve, the criminal they identify, the rewards they win. Finger Print Experts are always in the thick of the excitement, the heroes of the hour.

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Within the past few years, scores of men—men with no police experience, men with just ordinary-grade school educations—have become finger print experts. You can become a finger print expert, too. Can you imagine a more fascinating line of work than this? More trained men are needed. Here's your real opportunity.

Learn the Secrets of Identification

More and more the detection of crime resolves itself into a problem of identification. You can learn the methods of the famous identification experts. You can learn the science of Finger Print Identification—right at home in your spare time.

FREE—The Confidential Reports No. 38 Made to His Chief!

IF YOU ACT QUICK—We will send you free, a copy of the gripping, fascinating, confidential report Secret Service Operator No. 38 made to His Chief. Write quickly for fully illustrated free book on Finger Prints which explains this wonderful training in detail.

Institute of Applied Science
Dept. 14-28 1920 Sunnyside Av., Chicago

Institute of Applied Science, Dept. 14-28
1920 Sunnyside Ave., Chicago, Ill.

Gentlemen: Without any obligation whatever, send me your new, fully illustrated, FREE book on Finger Prints and the free Copy of the Confidential Reports of Operator No. 38 made to His Chief. Literature will NOT be sent to boys under 17 years of age.

Name _____

Address _____

City & State _____

_____ *Age* _____

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(While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.)

Consumers Prefer Blue

By James R. Lowell

AMERICAN business has suddenly become color conscious; and today we find color a predominating note in advertising. Merchantry is offering the public its choice of blue, green, red, and their various shades and combinations, in automobiles, shoes, frying pans, plumbing fixtures, bed sheets, and what not.

In view of the increasingly important rôle color is playing in modern merchandising, it is interesting to observe the results of experiments in color preference conducted over the past four years by William E. Walton, Instructor in Psychology at the University of Nebraska. Mr. Walton has developed a machine which he calls the "chromopathometer" and with which he is working at present to determine the affective values of colors and their combinations on human beings. It is to demonstrate the method of impression and paired comparisons, to determine the reaction and perceptibility of the visual system to various colored lights, as well as other more or less scientific facts. More than 800 students have been used in the psychology instructor's experiments at the State Universities of Nebraska and Kansas.

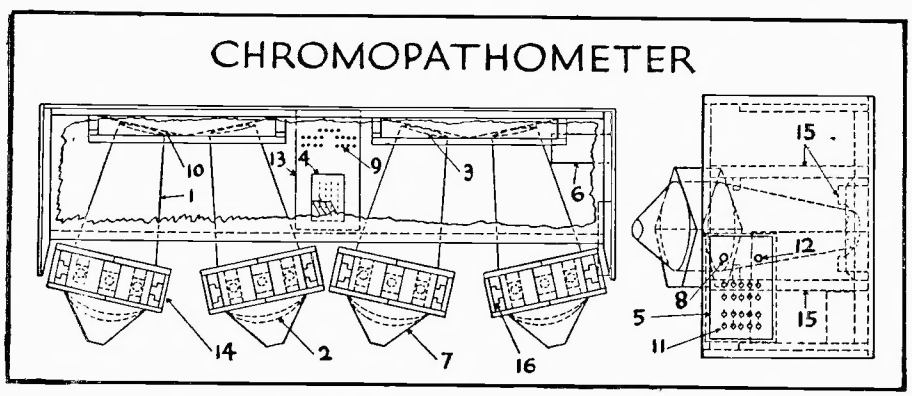
One of the most important uses of the chromopathometer is its capacity for measuring the affective values of colored lights such as are used in electric advertising. This idea, original with Mr. Walton, readily shows to which colors the human mind reacts the quickest. For example, in a test given to determine the perceptibility of colored lights, it was found that the red light exposed through a pin-point hole for one two-hundredth of a second was recognized readily as being that color. All other colors were more or less misnamed, while blue could not be perceived at all. Thus blue would be a poor color to use in a flasher sign or traffic stop light, while red, now generally used, is the best.

On the other hand, in regard to outdoor advertising, it is desirable that a color be used which will not attract attention because of its disagreeableness, but will focus the attention of the observer upon what is advertised. From a test given to a large group of university students, it was found that blue was the color most preferred, with green ranking next. Where women alone are considered, however, it is found that green is preferred, with red second.

When the intensity of all the colors was made equal, through resistance coils in the chromopathometer, it was discovered that both men and women preferred red and the conclusion was arrived at that the intensity of the color is a large factor in influencing the preference. Thus an ideal sign would be one of a red color, with an intensity that would attract attention and yet not prove disagreeable, as many red signs are prone to do.

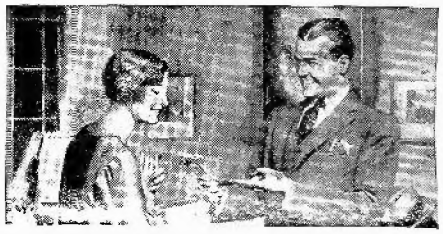
For color combinations it was found that red and blue appealed to most men, while women favored white and green. In general, red and blue are liked by both sexes and make a good combination to be used in signs advertising general commodities. Mr. Walton has discovered. The machine also reveals that man is more consistent in his choices than is woman and that the male prefers saturated colors in combination with each other, while the woman as a rule prefers a saturated color in combination with an unsaturated one. For instance, red and blue for men, white and green for women.

Manufacturers conducting sales campaigns in foreign countries may take a tip from the psychology of color preference, viz., colors endeared to a people through patriotic association, or colors corresponding with the outdoor colors peculiar to nature in a given location, are certain to prove popular.



1 Projector
5 Switch-board
8 Main Switch
11 Small switches
14 Socket rack
2 Reflector
3 Lens
6 Plug and fuse box
9 Binding posts
12 Switch-board light
15 Projector rack
4 Switch
7 Reflector shield
10 Frosted glass
13 Resistance box
16 Light socket
3/32" scale

An accurate diagram of the chromopathometer



"Last night I came home with great news"

"I'd TELEPHONED Ruth that I had a surprise for her and she could hardly wait for me to get home. You should have seen her face when I told her the Boss had given me a $25 increase in salary.

"'It's wonderful,' she said, 'just wonderful. Now we can pay those bills and even start saving.

"'Remember the night we saw that coupon in a magazine and you decided to take up an I. C. S. course? It made a new man of you, Bob, and I knew it wouldn't be long before the firm would notice the difference in your work. We certainly owe a lot to the International Correspondence Schools.'"

How about *you?* Are you always going to work for a small salary? Or are you going to get ahead? It all depends on what you do with your spare time.

Don't let another precious hour pass before you find out what the I. C. S. can do for you. It doesn't cost you a penny or obligate you in any way, but it may be the means of changing your entire life. *Do it now!*

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☐ Advertising	☐ Lumber Dealer

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City.....

Occupation.....

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NEWEST IN RADIO! 1931 Miraco "Easy-Chair" model with magazine racks, each end. Place it anywhere in any room. Easily moved about. Contains a complete full-size radio and Super-Dynamic speaker! No outside aerial or ground required. Many other new, clever models, obtainable nowhere else, shown in free literature.

Get Our "SEND NO MONEY" 11th Anniversary Offer!

Latest 1931 **Super Screen Grid** FULL YEAR'S GUAR.

lighted 1 dial steel chassis

Vari-Tone *and* **Automatic Sensitivity Control**

Also latest PUSH-PULL Amplification

Built like—looks like—performs like newest radios in many outfits much more costly. Latest, finest, heavy duty construction. Skilfully engineered to super-utilize a battery of "224" SCREEN GRID tubes—in addition to "245" PUSH-PULL POWER, "221" HUM-FREE long-lived POWER DETECTOR and AMPLIFIER and "280" A-C TUBES. *Vari-tone* feature gives any tone-pitch your ears prefer. *Automatic Sensitivity Control* reduces "fading," protects tubes. Phonograph pick-up connection. Built-in house wiring aerial and ground. Built-in plug for electric clock, lighter, lamp, etc. Super-sturdy power section. Razor-edge selectivity; Super-Dynamic Cathedral tone quality; marvelous distance-getter. Solid one-year guarantee if you buy! Wide choice of cabinets.

Easy Chair Model
(as illustrated less tubes)

Only $49.88 COMPLETELY ASSEMBLED

Values possible because you deal direct with big factory

MIRACO

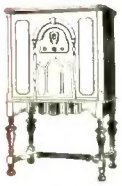
TRADE MARK REGISTERED

CATHEDRAL TONED, SUPER SELECTIVE, POWERFUL DISTANCE GETTERS

NEW LOW FACTORY PRICES SAVE to 50%

Similar Low Prices on Beautiful Variety of Latest Fine Consoles Send Coupon!

30 DAYS' FREE TRIAL



Full-size wall console with latest 1931 features. Beautiful design and woods. Priced very low, factory to you.

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Medium-size "Hi-Boy". Sliding doors. Rich design, fine woods, fine finish. Astonishingly low factory price to you.

These Consoles are Equipped with **SUPER DYNAMIC CATHEDRAL TONE REPRODUCERS**

Also built-in aerial and ground and built-in extra light socket!

Magnificent new creation. Super Screen Grid Radio. Phonograph under same lid. Greatly under priced. Send coupon for low factory to you prices.

You need not send us a cent! For its 11th successful year, America's big, old, reliable Radio Factory again sets the pace in high-grade, latest guaranteed radios *direct to you*. And now—at history's greatest savings. With this newest perfected SUPER SCREEN GRID, push-pull, super-powered and humless electric AC set in clever, beautiful new Miraco-Mastercrest consoles obtainable nowhere else—you are guaranteed satisfaction, values and savings unsurpassed. *Get Amazing Special Offer!*

At our risk, compare a Miraco outfit with highest priced radios 30 days and nights. Surprise, entertain your friends—get *their* opinions. Unless 100% delighted, *don't buy!* Your decision is final—no argument!

Only marvelously fine radios, of latest perfected type, at rock-bottom prices, can back up such a guarantee. Send postal or coupon for *Amazing Special Factory Offer!*

Don't Confuse with Cheap Radios

With Miraco's rich, clear Cathedral Tone, quiet operation, razor-sharp separation of nearby stations, tremendous "kick" on distant stations, Vari-Tone and automatic sensitivity control, and other latest features—be the envy of many who pay 2 or 3 times as much!

Send for proof that delighted thousands of Miraco users cut through locals, get coast to coast, with tone and power of costly sets. Miraco's are built of finest parts—approved by Radio's highest authorities. Our 11th successful year!

USER-AGENTS WANTED
Exclusive Territory—Try it at Our Risk!
Spare or full time. No contract, no experience required. Big money! Send coupon now!

Deal Direct with Big Factory

Miraco outfits arrive splendidly packed, rigidly tested, to plug in like a lamp and enjoy at once. No experience needed. Entertain yourself 30 days—then decide. Liberal year's guarantee if you buy. Play safe, save lots of money, insure satisfaction—deal direct with Radio's big, reliable, pioneer builders of fine sets—successful since 1920. SEND POSTAL OR COUPON NOW for Amazing Offer!

EASY TERMS to reliable persons only

SEND for AMAZING SPECIAL OFFER

MIDWEST RADIO CORP., 409-AN Miraco Dept., Cincinnati, Ohio

BEAUTIFULLY ILLUSTRATED LITERATURE, TESTIMONY OF NEARBY USERS, PROOF OF OUR RELIABILITY—

All the proof you want—of our honesty, fairness, size, financial integrity, radio experience and the performance of our sets—including Amazing Factory Offer—sent without obligation!

Free!

MIDWEST RADIO CORPORATION
Pioneer Builders of Sets—11th Successful Year
409-AN Miraco Dept., Cincinnati, Ohio

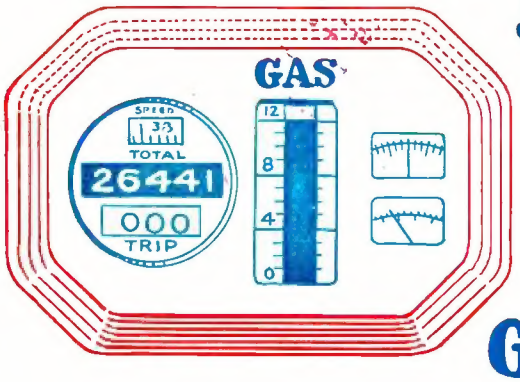
THIS COUPON IS NOT AN ORDER

WITHOUT OBLIGATION, send latest literature, Amazing Special Free Trial Send-No-Money Offer, testimony of nearby users and all Proof. ☐ User. ☐ Agent. ☐ Dealer

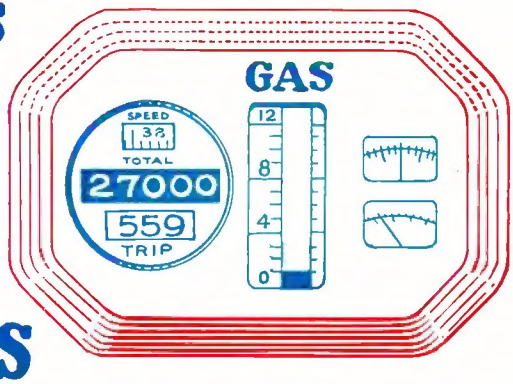
☐ **Check here if interested in an EXCLUSIVE TERRITORY PROPOSITION**

NAME.....ADDRESS.....

Over the Mountains from Los Angeles



559 Miles on 11 Gallons of GAS



Think of it! FIVE HUNDRED FIFTY-NINE MILES over rough mountainous country burning only ELEVEN GALLONS OF GASOLINE. Imagine more than FIFTY MILES to the GALLON. This is what the WHIRLWIND CARBURETING DEVICE does for D. R. Gilbert, enough of a saving on just one trip to more than pay the cost of the Whirlwind.

THE WHIRLWIND SAVES MOTORISTS MILLIONS OF DOLLARS YEARLY

Whirlwind users, reporting the results of their tests, are amazed at the results they are getting. Letters keep streaming into the office telling of mileages all the way from 22 to 59 miles on a gallon, resulting in a saving of from 25 to 50% in gas bills alone.

Mark H. Estes writes: "I was making 17 miles to the gallon on my Pontiac Coupe. Today, with the Whirlwind, I am making 35 5/10 miles to the gallon. Am I glad I put it on? I'll say so!"

P. P. Goerzen writes: "I made an actual test both with and without a Whirlwind, getting 13½ miles without and 34 6/10 miles with the Whirlwind, or a gain of 21 miles to the gallon. The longer the Whirlwind is in use on the machine, the better the engine runs, has more pep and quicker starting. It makes a new engine out of an old one, and starts at the touch of the starter button."

R. J. Tulp: "The Whirlwind increased the mileage on our Ford truck from 12 to 26 miles to gallon and 25% in speed. We placed another on a Willy's Knight, and increased from 12 to 17 miles per gallon.

Arthur Grant: "I have an Oakland touring car that has been giving me 15 miles to the gallon average, but I can see a great difference with the Whirlwind, as it climbs the big hills on high and gives me better than 23 miles to the gallon of gas, which is better than 50% saving in gas."

W. A. Scott: "I had my Whirlwind for three years. Winter and summer it gives the same perfect service, instant starting, smoother running, and what I saved in gasoline these last few years has brought other luxuries which I could not have afforded previously."

Car owners all over the world are saving money every day with the Whirlwind, besides having better operating motors. Think what this means on your own car. Figure up your savings—enough for a radio—a bank account—added pleasures. Why let the Oil Companies profit by your waste. Find out about this amazing little device that will pay for itself every few weeks in gas saving alone.

FITS ALL CARS

In just a few minutes the Whirlwind can be installed on any make of car, truck, or tractor. It's actually less work than changing your oil, or putting water in the battery. No drilling, tapping or changes of any kind necessary. It is guaranteed to work perfectly on any make of car, truck or tractor, large or small, new model or old model. The more you drive the more you will save.

GUARANTEE

No matter what kind of a car you have—no matter how big a gas eater it is—the Whirlwind will save you money. We absolutely guarantee that the Whirlwind will more than save its cost in gasoline alone within thirty days, or the trial will cost you nothing. We invite you to test it at our risk and expense. You are to be the sole judge.

SALESMEN AND DISTRIBUTORS WANTED

To Make Up to $100.00 a Week and More

Whirlwind men are making big profits supplying this fast-selling device that car owners cannot afford to be without. Good territory is still open. Free sample offer to workers. Full particulars sent on request. Just check the coupon.

WHIRLWIND MANUFACTURING CO.
999-364-A Third Street Milwaukee. Wisc.

FREE OFFER COUPON

WHIRLWIND MANUFACTURING CO.
999-364-A Third Street, Milwaukee, Wisc.

Gentlemen: You may send me full particulars of your Whirlwind Carbureting device and tell me how I can get one free. This does not obligate me in any way whatever.

Name .....

Address .....

City .....

County ..... State .....

☐ Check here if you are interested in full or part time salesmen position.